Electrical World

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Weston

Weston Instrument Transformers, and How We Came to Make Them

A few years ago, at the time the Weston Company had perfected its now world-famous group of A. C. Switchboard Indicating Instruments, it found itself face to face with a very serious situation.

The Company had developed these Instruments to the highest state of perfection, but there were on the market no transformers of sufficient accuracy and serviceability to use in combination with them! Exhaustive tests were made on all types of Transformers available in this market, and the Weston branches and representatives in foreign lands were commissioned to scour the field and send samples of the best Transformers procurable.

Not one of the Transformers thus obtained in this country or abroad met the requirements even approximately.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

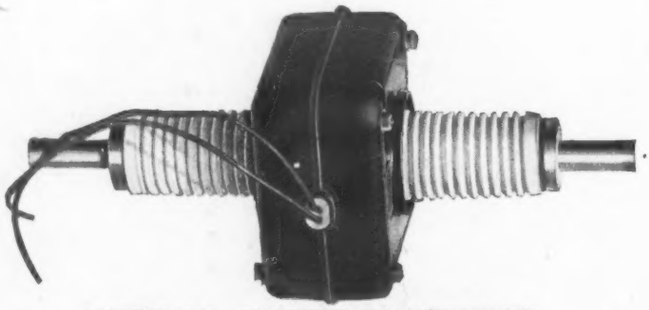
As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

Model 312

PORTABLE INSTRUMENT TRANSFORMER

Weston Switchboard Instrument Transformers described in Bulletin 1501.

Weston Portable Instrument Transformers described in Bulletin 2001.



MODEL 365 CURRENT TRANSFORMER

For Use on 13,200 Volt Circuits.

Home Office and Factory
13 Weston Ave., Newark, N.J.

New York	Chicago
Boston	Detroit
Philadelphia	Toronto
Buffalo	Montreal
Richmond	Winnipeg
Cincinnati	Vancouver
Cleveland	Berlin
Pittsburgh	London
St. Louis	Florence
Denver	Paris
San Francisco	Petrograd
Johannesburg, S. Africa	

Weston Electrical Instrument Co.

Electrical World

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Getting the Business Man's Viewpoint

WITH the development of the commercial side of the electrical industry has come a literature and a forum for the discussion of our common problems. Papers and discussions together form a background for the practice of to-morrow which bids fair to have as great an influence in the development of the industry as the similar exchange of experience has proved on the scientific and engineering sides of the industry. Out of the commercial development, however, there are yet to come definite principles of procedure. The commercial activities of the industry tend to be expressed in enthusiastic meetings of detail situations. Just now, for instance, the electric range is in the foreground and the commercial discussions are centering around the many and important problems of selling electric ranges. We need this type of interchange of experience but we need also a consideration of the relation of each of these questions to the fundamental questions of business policy. In our commercial discussions we tend to go to extremes in the interchange of detailed merchandising experience. We ought also to discuss and weigh the relative importance of certain subjects. The range, the electric vehicle, industrial power sales, the sale of power to electric street railways, the development of electro-metallurgical processes and the sale of electrical energy for them, all are now live topics. They need to be considered together. Not enough discussion as to their relative importance is presented. As the ELECTRICAL WORLD sees it, this is because the selling problems are not being discussed by men actually responsible for profits, but by specialists who are responsible for sales. There is a difference between the viewpoint of the man who has to meet a payroll every week and the man who is handling only the selling end of the business. The commercial problems of the industry need more discussion from the viewpoint of the men at the head of the business. Interchange of merchandising experience is important and essential but a balanced viewpoint on the commercial side of the industry comes only when the related detail sales plans are discussed and their relative importance weighed.

Heating Houses by Electricity

THERE is no denying that electricity for any purpose, but especially for house heating, is ideal. A chimneyless city is a consummation devoutly to be wished, but alas, we fear never to be realized except in sunny climes where winter is unknown and where the inhabitants are as anxious to rid themselves of heat as we are to get it. Taken by and large, coal at $10 a ton is a cheaper source of heat than electricity at $10 a kilowatt year, and it is well for central station managers to face the fact. In some sections of the country where water power in sufficient quantity is available, in the absence of a better market, there has been a tendency to indulge in the hope of obtaining the money which usually goes to the coal man. So long as this is confined to supplanting other forms of stoves by electric ranges for cooking purposes, the movement is reasonably sure of success; but beyond that it is doomed to failure. There have been a few special cases of electric heating such as at Rupert, Idaho, where the government supplies the school houses with energy from the reclamation service generating stations which otherwise would be idle during the winter. But one swallow does not make a summer; if there have been successful installations in Idaho with government help there have been failures there also, as witness Twin Falls. A wide field exists for portable electric heaters which are used intermittently when severe cold does not obtain and for removing chill from the atmosphere of rooms; but except in rare cases there is no field for a system of electric house heating to replace the standard forms now in use employing coal, with coal at present prices.

National Action on National Problems

ELECTRICAL manufacturers believe that the Webb bill unclouded by amendments should pass the Senate in this session of the Congress. In its present form it permits combinations of competitive manufacturers for the promotion of foreign trade. The effect of the Webb bill is psychological quite as much as legal. Our representatives at Washington quite properly are considering its terminology and provisions from the legal viewpoint. As a federal statute it should not conflict with other statutes, such as the Sherman law, now forming a part of our federal commercial law. Stripped of words, however, the bill means that American manufacturers of electrical machinery and supplies may go ahead in any plan to meet foreign competition in foreign fields without the uncertainty that now marks any combination of effort under the Sherman law. At present, figuratively, a lawyer must be on hand at any conference between competitors in order that they may not be liable under the Sherman law restricting combinations in restraint of trade. The need of the Webb bill as one piece of directive legislation and its importance to electrical manufacturers is the more evident when conditions in the electrical industry abroad are realized. Important as are interstate industrial problems, more important still are the

international industrial problems growing out of the war and in which this nation as a whole must act as a whole.

Making It Easier to Buy Electric Vehicles

IT is too hard to buy electric cars in most localities. Consider the predicament of the buyer of a pleasure car who has made up his mind that for the average uses to which he and his family can put a car in a suburban town an electric is most desirable to buy. The general advantages have been listed often enough. Accept them as facts, and they may be so accepted, and take the next step. He decides on a car. The first cost is high though not higher than an inclosed gas car for the same luxurious riding. But discount the price barrier because cars are being sold in some quantity, and volume is a factor in price. We will get a better price when we get a bigger market. That is the manufacturer's problem and he is working at it. Then the question comes to the buyer: How shall he get the battery charged? In relatively few cities an electric garage gives him the answer. For a nominal sum by the month he can have his car receive expert care. A few central stations have taken initiative in this direction and individual experiences indicate that the experience is a profitable one. But in the average community the problem of how to get direct current for charging his electric car from alternating current is *strictly up to the buyer.* He must buy a car, then he must buy a charging outfit.

There is a new interest in the electric vehicle for both pleasure and commercial cars. Difficulty in charging seems to be a sticking point in the marketing of the electric in the average community to-day. The ELECTRICAL WORLD reiterates its belief that the electric car to-day has a field of usefulness that is only dimly recognized. It believes after considering all the factors involved, that the central station must realize as never before its responsibility as a seller of electric current. The problem is not hard. Apparatus exists both in rectifiers and in small motor-generator sets to meet the conditions. But a more intelligent and more widespread knowledge of just how to put the apparatus at work in the average buyer's garage is essential. Some central stations are prepared with that information but they are few indeed. Let us concentrate on this problem of the buyer of the car. Start with alternating current convenient at his door. How shall he transform it to direct current, what apparatus shall he buy and what will it cost? Does the central station sell outright, on part time or rent the apparatus? If he buys it from a manufacturer other than the maker of the car, who guarantees it? What rate does he pay by the month for current? Who can tell him how best to charge his car? These are only a few questions to which an actual buyer has had difficulty in finding answers. Every central station ought to have the answer. There are only a handful that have looked at the question of charging the electric vehicle from the buyer's point of view.

Interference Between Electric Circuits

WITH the inevitable increase in electric supply, railway, telephone and telegraph networks, the disease of inductive interference is more and more aggravated. Aside from the work done by the committee of engineers appointed by the California Railroad Commission very little that is constructive has materialized. Engineers of transmission companies and of telephone companies occasionally take a fling at each other, but their work being in the main destructive comes to naught. Various panaceas have been offered, such as separating the lines, transposing the circuits, placing them underground, etc., one side seeking to place the whole burden of effecting a cure on the opposite side. Now nothing short of active co-operation between telegraph and electric supply engineers will avail. It is futile to talk of complete separation of the two types of circuit, when increasing densities of population and simultaneous demands for both electric communication and power involve interspersed networks of both sets of wires. Nor is it possible to say off-hand that all communication wires or that all the power wires shall be placed underground. Apart from the question of expense, it may not be feasible in some instances to operate either or both systems underground. Where a telephone system has been properly installed in a district, and the district has then been invaded by a power system in such a manner that the telephone service has been interfered with, damages have occasionally been awarded to the telephone from the power systems by the courts, but it is manifest that judicial settlements of such vexed questions can only serve as local palliatives to a widespread electro-social disease. The telephone companies may be honestly endeavoring to keep out of trouble, and the power companies may be honestly endeavoring to avoid making themselves opprobrious, and yet the co-extensiveness of both sets of lines may cause the telegraph and telephone service to suffer.

The only way to deal with the situation comprehensively in the future is to insist on co-operation, and to get off the ground. Any electrical circuit, be it for telephonic, telegraphic or power transmission, which employs the ground as a permanent return renders immunity from interference almost impossible. The co-operation must be carried out both technically and administratively. Not only must the engineers of the power and communication systems work together understandingly for the mutual benefit of their subscribers, but the managements must also work together under the advice of their engineers to make such dispositions and accommodations as may be economically and mutually advantageous for minimizing interference.

An intelligent insight into the technical nature of telephone and telegraph interference, combined with business foresight and reasonableness, will ordinarily suffice to prevent disturbance and avoid litigation. In most instances, litigation is only a confession of either misunderstanding or unforbearance on at least one side.

Oil Switch Design and Rating

TO what extent do the limitations in rupturing capacity of available circuit-breaking devices control the size of generating and substations, the practice in paralleling stations and the economical use of conducting material in transmission lines and underground cables through parallel and interchange connections? The modern practice is to design alternating-current generators and other apparatus with high reactances to limit the possible current in buses and feeders. In plant design and system operation of to-day concessions are frankly made to meet the known or estimated limits in ability of oil-circuit breakers to interrupt currents accompanying break-down or short-circuits. On the typical large systems these currents are measured in tens of thousands of amperes.

The meeting of the American Institute of Electrical Engineers, held in Boston Dec. 8, was devoted to a consideration of questions affecting a rational rating of the rupturing capacity of oil-circuit breakers. Apparently little stands in the way of a general agreement that the duty assumed by (or imposed on) the switch is measured by the highest current flowing after the contacts part, taken in connection with the operating voltage of the system. On account of the transient nature of currents involved, and because three-phase systems are usually considered, with probability of unbalance, there may be some difficulty for a Standards Committee over the exact wording of a rating clause. The real difference of opinion will be over the criteria for satisfactory rupturing performance. A circuit may be ruptured and the system as a whole saved from extensive damage, shut-down and loss of prestige, but at the expense of a completely wrecked switch, a station messed with oil, and a demoralized operating crew. Between the current causing such self-destruction and the current interrupted without any external or internal evidence of distress a fair rating for the breaker must be selected.

Worth-while tests for extreme duty can be made only on large systems in regular operation, and much credit is due those having the foresight and courage to offer their plants for such tests. Such tests cannot be frequently made and at best fall short of the severest conditions, since Sundays, holidays or the small hours of the night are usually selected. Even the most courageous would not select the hour of winter peak to throw a short-circuit deliberately on a system. Though the switch designers have intimated that cost and needed space are the only bar to supplying oil breakers to meet the demands of any conceivable service without throwing oil or otherwise showing distress, we are disposed to question the ability to do this until such times as oil-circuit breaker design becomes based on exact data. Though many ingenious testing and recording devices have been applied, little is really known of what actually goes on electrically, thermally, chemically and mechanically around the submerged contacts during the two or three cycles between contact parting and current interruption. A sound working theory of "how a breaker breaks" is much needed and is the next logical step in advancing the art of oil-circuit breaker design.

Standardization of Control Connections

OUR weekly digest opens in this issue with a reference to a plea for standardization of a certain kind, by Charles C. Garrard, as recently published in *The Electrician*. The article points out the great convenience and simplification capable of being introduced into three-phase switchboard operation, by marking the three individual phases throughout, in distinctive colors. Red, white and blue are the colors advocated, and there should be no objection from the entente; but red, yellow and blue, are also recognized as suitable. This practice in central stations is fairly common throughout the world, and has very distinct advantages. The article recommends its general adoption and its extension to certain details.

Moreover, the article makes a vigorous appeal for single current transformers in each phase of high-tension switchgear operation. That is to say, instead of employing a special current transformer for wattmeter service, another for relays, another for ammeters, and yet another perhaps for trip coils, it is recommended that one and only one series instrument transformer shall be employed in any one phase, for the series operation of each and all such services. This requires giving greater care and attention to the design of the switchboard current transformers; but it greatly simplifies the connections. The condition advocated presupposes, of course, that the extra loads in the current transformer secondaries will not appreciably affect their behavior, a beneficent result that has by no means been generally attainable in the past.

The Coming Issues

THE final issue of the ELECTRICAL WORLD for the year, in addition to the semi-annual index, will contain a leading article presenting interesting features of a modern generating station of medium size. Another article will explain a graphical method for calculating the sizes of direct-current busbars, and will include practical charts. A third article will show, by means of a number of pictures, how an electrical layout has aided in speeding up production in a large industrial plant. The ELECTRICAL WORLD for Jan. 6 will be the annual review number, a feature of which will be a statistical analysis of 1916 in the electrical industry. A group of representative authors have also contributed for this number authoritative reviews on developments in special branches of the industry during the year. The December number of ELECTRICAL MERCHANDISING, the new monthly magazine of the electrical trade, appeared on the fifteenth of the present month, and to its pages are referred commercial readers who are interested in detail selling methods.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

CONGRESS ACTS TO RELIEVE NIAGARA POWER FAMINE

Bill Introduced to Permit Secretary of War to Grant Additional Diversion of Water for One Year Up to Treaty Limits

Forced by insistent demands made by Canadian industries for additional electric power, the Ontario Hydro-Electric Commission has appropriated an additional 12,500 hp. from the Canadian Niagara Power Company, Niagara Falls, Ontario. The commission is now receiving within 4000 hp. of the 50,000 demanded for domestic use within the province so there is now danger of an absolute embargo on all exportation.

The Buffalo General Electric Company has sent letters to large power consumers urging them to curtail operations between 4 and 6.30 o'clock every afternoon.

Large electrochemical and other industries along the American Niagara frontier which have been depending upon this Canadian power to keep their plants in operation have been seriously crippled by the arbitrary manner in which this latest embargo was ordered. Representatives of all American Niagara power generating companies together with committees of commercial organizations in western New York were in Washington this week advocating increased diversion from the American channel. So impressed were Congressmen with their case that Chairman Flood of the foreign affairs committee introduced on Tuesday a joint resolution in the House authorizing the Secretary of War to permit the use of all the water allowed under the treaty with Great Britain—an extra 4400 cu. ft. per second. The grant to the Secretary of War is to be only for a year. Senator Wadsworth offered the resolution in the Senate which passed it Wednesday.

The resolution provides:

"That the Secretary of War be and he is hereby authorized to issue permits, revocable at will, for the diversion of water in the United States from the Niagara River above the falls for the creation of power to individuals, companies or corporations which are now actually producing power from the waters of said river, in additional quantities, which, with present diversions, shall in no case exceed the capacity of the generating machinery of the permittee and tenant companies now installed and ready for operation, nor an amount sufficient to enable the permittee to supply the now existing hydroelectric demands of the individuals, companies or corporations which said permittee and tenant companies are now supplying, but not in excess of the capacity of power-using appliances of said consumers now installed and ready for operation: Provided, that in no event shall the total quantity of water diverted from said river above the falls for power purposes exceed in the aggregate a daily diversion at the rate of 20,000 cubic feet per second: And provided further, that this resolution shall remain force until the first day of July, 1917, and no longer, at the expiration of which time all permits granted hereunder shall terminate, unless sooner revoked; and nothing herein contained shall be held to confirm, establish on confer in or upon any such permittee any right in or to the water which is is now diverting or which he may be authorized to divert hereunder."

PATENT OFFICE WORK SERIOUSLY HAMPERED

Failure of Congress to Make Appropriation for Additional Examiners Comes as a Disappointment to Patent Office Officials

Failure of the House appropriation committee to grant in the legislative appropriation bill just acted upon the increase of fifty new members of the examining corps of the patent office asked by Commissioner of Patents Thomas Ewing has caused great disappointment among the officials of the office and among officials of the Interior Department at large.

The work of reclassification of patents could be completed in five years if Commissioner Ewing's request had been granted, but at the present rate of work, with the present force, the reclassification will take thirty years more, high officials of the patent office point out.

The work of reclassification of the thousands and thousands of patents granted has already been going on for seventeen years.

"The commissioner prepared a scheme whereby the work could be completed in five years," said an official discussing the decisions of the appropriations committee of the House, as made public. "Now the failure to grant the increase of $200,000 asked for the fifty new members of the examining corps will necessitate the work dragging on for years.

"The failure to grant this appropriation is especially regrettable," the official continued, "since the patent office is more than self-sustaining, having turned into the Treasury of the United States during the last fiscal year more than $282,000, as Commissioner Ewing pointed out in his official report.

"The inventors of the country are paying for better service than they are getting. They are paying in fees, while the patent office is not in a position to do its work properly, owing to the great confusion which exists in the classification of patents. Every year patents are granted which should not be granted.

"It is from this standpoint that the failure of Congress to allow the appropriation asked for by Commissioner Ewing is especially regrettable. This opinion is shared by all the officials of the office."

DALLAS FRANCHISE PROGRESS

Commissioners Have Had First Reading—Have Until March 8 to Call for Referendum Vote

The Dallas (Tex.) voters having expressed in the postcard vote by an overwhelming majority their approval of the granting of the proposed franchise for electric and railway service, the commission of the local government has already had the first reading of the franchises and will hold the second on Jan. 8. Sixty days from that date are allowed within which a referendum vote may be called on the demand of 500 voters. Should a referendum vote be called the matter will be presented to the voters for their action at the spring election, which is held early in April. Until the franchises are actually granted nothing definite will be done regarding the management and financing of the properties.

COMPROMISE IN MEMPHIS

Companies Grant Reduction in Lighting Rates—City Agrees to Permit Consolidation

A compromise has been effected between the City of Memphis, Tenn., and the local lighting utilities, the Merchants' Power Company and the Consolidated Gas & Electric Company. A reduction in lighting rates to 6 cents per kilowatt-hour with a 30 cent service charge is granted by the companies while the city agrees to cancel its $1,500,000 issue of Municipal light plant bonds and permit the consolidation of the two companies. The city has abandoned its plan for a municipal plant. High construction costs and the too great indebtedness which would have resulted had the city issued the plant bonds deterred the city officials from further following out the municipal plans. Following is the memorandum of agreement between the city and the corporations so far as it pertains to electric service:

Conditions.—Penalty, $100,000—$42,000 cash and $10,000 per year for six years. Consolidation and extension of franchise to cover expiration of bonds.

Rates.—Street arcs, or 600-cp. gas filled lamps, $50 per year.

Electric Lighting.—Thirty cents service charge. Six cents for first 80 kw.-hr. or fractional part thereof. Five cents for next 120 kw.-hr. or fractional part thereof. Four cents for next 300 kw.-hr. or fractional part thereof. Three cents for all in excess of 500 kw.-hr. Provided, however, that no customer's bill shall exceed on an average in any calendar year, or fractional part thereof up to the time of the final bill, 7.5 cents per kilowatt-hour, through one meter. The foregoing adjustment to be made at the end of each calendar year, or on demand of the customer when a final bill is rendered by reason of the customer quitting the service through change of residence or other conditions. No minimum. No renewals.

Electric Power.—Power rate to remain the same. Rates herein provided to begin as of Jan. 1, 1917.

No exclusive franchise hereby given the companies, and city does not relinquish right to build municipal plant.

Restrictions and limitation imposed upon the company to remain same except as hereby modified.

MAINTENANCE COSTS OF ARC LAMPS FOR STREET LIGHTING

Boston Edison Company Presents Data in Controversy Over Rates Before Massachusetts Gas & Electric Light Commission

Various data bearing upon the cost of maintenance of magnetite arc lamps in Boston proper were recently presented by L. L. Elden of the Boston Edison company before the Massachusetts Gas and Electric Light Commission. For an average of 4489 6.6-amp magnetite arc lamps in service the yearly cost of trimming per lamp was $9.94. The number of lower electrodes required was 277,726 and the average number of trims per year per lamp was 61.2. There were 3828 hours of burning. The average service life per lower electrode was 62.5 hours, seventy hours being the maximum observed. No salvage is realized on the electrode stubs. The longest trim period, occurring in July, was about nine days. The route schedules for the various trimmers from week to week are made out by the head of the trimming department, who delivers the schedules to the stockroom at the General Service Buildings on Massachusetts Avenue, which is the headquarters of the work for the entire system of about 700 square miles. Requisitions for electrodes are signed by a representative of the installation or trimming department, who is in charge of the trimmers, after which the electrodes are taken from the stockroom to the loading platform, sorted and delivered by stock boys according to cabinets assigned to each trimmer. The stock boys apportion the electrodes according to routes, number of lamps per route and trimming period, and when the trimmers arrive at the plant before beginning a day's work no time is lost in waiting for electrodes. An average yearly consumption of globes for the above number of lamps is 11,752, or 2.6 globes per lamp-year. Frequent changes are required by heavy slagging and pitting of globes, due to the mineralized material of the electrodes being thrown against the side of the globe. This is a cumulative process, and finally results in a bad appearance from the street. One standard size and shape of globe is used for magnetite lamps of the standard type throughout the system. Eighty-five per cent of the globes are destroyed after being removed from the lamps, the remainder being cleaned of slag and soot and discoloration and used again. The yearly maintenance cost of the above lamps also includes an outlay of $445 for lamp parts, such as burned electrode holders, screws, globe-holder rings, etc. The transportation cost incurred in trimming lamps in Boston was $7,298. The total pro-rated labor cost in trimming in Boston proper was $11,108 for fifteen trimmers and $2,250 for part time of clerks, stockmen and trouble men, or a total of $13,358. Eleven trimmers are engaged in regular service on regular routes; one trimmer does nothing but change upper electrodes, and two spare men are carried on the payroll. The copper electrodes are changed about once a year, the estimated life being 4000 hours. Trimmers average ninety-five pole-type lamps per day each on regular routes. Twenty-four bracket-type lamps represents a day's work for a trimmer on account of their scattered location and the necessity for using an extension ladder in most cases. A six-day trim period exists during most of December and January. An automobile is of little use on trimming in congested district compared with a horse and wagon. Trimmers report at 7 a. m. and report back at headquarters at 4 p. m., no circuit being operated until the afternoon report comes in. The total trimming labor was 4490 days, for which the men were paid on an average $2.22 a day. Additional labor charges at a different rate were as follows: New trimmers were employed, requiring breaking in, aggregating 126 days at $2 each. There were also three men employed during the year to make a general overhaul of the magnetite lamps on the system, the charge for their time in Boston proper being $1,071. The grand total trimming charge for labor was $12,401. The number of upper electrodes changed was 3893. During the year the company repaired 5516 magnetite lamps. The average price paid for lower electrodes was 5 cents.

EXPERIENCE WITH THORAN ARCS

Referring to the 1600-cp. direct-current Thoran arc lamps of 500-watt rating used in the illumination of various public squares, Mr. Elden said that the cost of trimming, patroling and labor per lamp is about $242 per year, the trimming costing $142. The income per lamp is only $148. The company did not anticipate a loss on these lamps when they were first placed in service. They were installed on account of the desire of the city to light large areas more economically than was feasible by the standard magnetite lamp. The performance was erratic, two trims a night being necessary at times. One such lamp usually replaced three or four magnetites. Owing to the high cost of opera-

tion the company has lately discouraged their extension, and at present but twenty-four are in service out of a maximum of about forty. The chief element of cost is the labor required to maintain continuous service. The lamps are widely scattered, and this increases the cost of patroling and trimming. The lamps to-day are running along very well, but they have to be changed frequently, brought into the shop for overhauling and repairs, and trimmed nightly. Mr. Elden estimated a fair price for these lamps under present conditions at about $325 per year each. This figure is based upon an investment average of $625 (the unit cost which the Boston Edison company figures for its entire street lighting system per arc lamp), with a fixed cost of $82.55.

NEW METHOD FOR CHARGING STORAGE BATTERIES

Mechanical Rectifier Is Designed to Give an Initial Charging Voltage Below Normal Battery Voltage

In a recent patent (No. 1,205,620) Varian M. Harris, Chicago, Ill., the inventor, gives an interesting theory of the apparent inefficiency observed when charging storage batteries from rectified or pulsating circuits.

In the charging of a storage battery an appreciable time element is necessary for the chemical reactions to take place within the battery, and for this reason if a phase wave is cut at the points which correspond in voltage to the voltage of the battery, the latter will not be charged, since it does not respond instantaneously to the current which passes into it, and sparking will result.

In order to overcome this difficulty, the phase waves should be cut at appropriate points so that the rectified current passes to the battery at a voltage considerably below the normal voltage of the battery. The chemical changes immediately begin to take place in the battery, and by thus allowing the current to flow to the battery at a decreased voltage, the chemical changes have become sufficiently started so that when the voltage of the rectified current reaches the normal voltage of the battery, the rectified current is allowed to flow to the battery.

This result is accomplished by constructing the segments of the mechanical rectifier of such a width that the phase waves of the rectified current are cut at a voltage sufficiently below the normal voltage of the battery so that the time when the voltage of the rectified current is increasing up to the voltage of the battery is sufficient to overcome the electrolytic lag of the latter.

DELAY IN KANSAS CITY RATE FINDING EMBARRASSING

Advocates of Municipal Plant Etxending Every Effort to Secure Widespread Support Before Commission Makes Decision

Announcement of the location of the power plant to be erected by the Kansas City (Mo.) Light & Power Company, will probably follow quickly upon the publication of the Public Service Commission's findings with reference to rates in Kansas City. The company has, it is said, already selected a site, which is understood to be on the Missouri River, north of Kansas City. The plant is to cost at least $5,000,000, and will be planned to supply current to communities and industries within a large radius. The details of the expenditure and of the location will not, however, be announced until after the commission has issued its findings.

The delay is causing more or less embarrassment, because of the agitation for a municipal light plant. Several local associations have started campaigns for a city plant, and the mayor has tentatively announced the submission of a proposal to vote bonds for this purpose next spring. The advocates of a municipal plant are extending every effort to secure as widespread support as possible before the rate decision is made, and before the company announces its plans. In some of the newspapers, the mere mention of the subject of a municipal plant at a public meeting is made to serve as an endorsement of the plan.

The Kansas City Commercial Club has gone on record as being willing to contribute a large share of the funds for a careful and expert investigation of the feasibility of a municipal plant for Kansas City, Mo., considering the engineering, the economic and the bonding questions involved. The Commercial Club's statement closes:

"If the investigation shows that any material reduction can be made by a municipally owned electric light plant in the rates then obtainable from the privately owned plant, The Commercial Club will do everything possible to aid the city to acquire such municipal plant."

This paragraph also expresses somewhat the attitude of J. H. Lucas, president of the Kansas City Light and Power Company. He has said to many persons, that the company desires the most thorough investigation of the subject of municipal ownership and of his company's service, and that he would assist so far as possible in such an inquiry.

ILLINOIS CENTRAL OFFERS TO ELECTRIFY SUBURBAN SERVICE

Electrification Plans Include Subway for Joint Use with Local Transportation—Work to Be Completed Within Five Years

An ordinance has been prepared by the Illinois Central Railroad and presented to the Chicago Terminal Commission, which proposes the electrification of the company's suburban service from Randolph Street south to the city limits on the main line, and a portion on this same line outside of the city limits as far as the Matteson Station, and the three branches to South Chicago & Blue Island and Kensington. This proposed electrification plan comprises only a small part of the proposed ordinance which takes up the consideration of establishing a new harbor district, securing park development, bathing beaches and streets over the tracks communicating with these, and providing for a new passenger station and other public advantages and benefits. The complete ordinance includes concessions on the part of the city and company, among the latter being the electrification plans.

The electrification plans are not made to include the through-train service coming into the terminal station, for the reason that it is considered vital to the possibilities of the new terminal that provision may be made for other railroads to use this new station. The proposed ordinance of the Illinois Central Railroad plans that the through trains will still be brought into the station under steam power.

This proposed ordinance is to be submitted by the Chicago Terminal Commission to the City Council on Dec. 20 without recommendations from the terminal commission. The matter will then be taken up for the direct consideration of the City Council.

STEAM FROM VOLCANO IS UTILIZED IN POWER PLANTS

Arrangements by Which Three 3000-Kw. Steam Plants Are Now Operated on Volcanic Steam in Italy

Prof. Luigi Luiggi of the University of Rome, Italy, reports the successful utilization of volcanic steam to operate three 3000-kw. steam plants at Larderello, in central Tuscany, Italy. Numerous cracks in the ground there permit powerful jets of superheated steam to escape in the air, besides boric acid and other mineral substances. Prince Ginori-Conti, president of the "Societa Boracifera di Larderello," in 1903 tried to utilize this superheated steam for the production of motive power. He first applied a strong jet to a small rotary motor, and then to a very modest reciprocating steam engine connected to a dynamo, which generated sufficient electricity to light part of a borax works. Later holes were bored in the ground and iron pipes driven down to the very source of the steam, which is under a hard stratum of rock about 300 to 500 ft. below the surface. These bore-holes vary from 12 to 20 in. in diameter, and give forth steam with a pressure of from 2 to 3, and exceptionally up to 5, atmospheres, and temperatures varying from 150 deg. C. to 190 deg. C.

Encouraged by these results, Prince Ginori-Conti, in 1906, applied the steam to an ordinary steam engine of about 40 hp. The experience of several years has shown that this arrangement works well so far as the mechanical power of the steam is concerned, but that the borax salts and the gases mixed with the steam—especially sulphuretted hydrogen and traces of sulphuric acid—have a corrosive action on the iron parts of the engine and are the cause of frequent repairs.

This difficulty was avoided by applying the superheated steam not directly in the engine, but to a boiler; that is, by applying it instead of fuel to an ordinary multi-tubular boiler, in which steam was produced at a pressure of 2 atmospheres, then passed through a superheater and afterwards used for driving a 300 hp. condensing steam-turbine, directly connected to a three-phase generator, which supplies the works and the villages around Larderello.

To carry out the experiments on a large scale Prince Ginori-Conti installed early in 1916 three groups of condensing turbo-generators, each of 3000 kw., working with superheated steam at 1.5 atmospheres generated in especially constructed multi-tubular boilers, the latter arranged vertically and with aluminum pipes, both for better utilization of the heat and better resistance to the corrosive action of the natural steam. The steam thus generated in the boilers after passing through the turbine is discharged into a surface condenser, whose circulating water is in its turn cooled in an ordinary cooling tower. The condensate from the turbines is pumped back into boilers, and thus no natural steam ever comes in contact with the turbine, by which arrangement corrosion is completely avoided.

The three-phase energy is generated at 6500 volts, 50 cycles, and stepped up through an oil transformer to 36,000 volts for transmission to Florence, Leghorn, Volterra, Crosseto, and many smaller towns of Tuscany. This energy is principally used as motive power for munition works during daytime and partly for lighting purposes at night.

One of the 3000-kw. group has been in operation since January, 1916, the second since April and the third has recently been started. So far the first two groups have worked quite successfully, and have been a great boon to the industries of Tuscany, greatly crippled by the scarcity and high price of coal. This successful harnessing of volcanic heat to an electric power house can be increased practically to hundreds of thousands of horsepower, since volcanic steam can be secured for many square miles around Larderello.

DECEMBER MEETING OF THE N.E.L.A. EXECUTIVE COMMITTEE

Recommendation to Establish Bureau of General Information and Data Files on Technical Matters Adopted

The December meeting of the Executive Committee of the National Electric Light Association was held at headquarters, New York City, on Dec. 8. Reports were heard from the chairmen of the various standing committees which were mostly of a routine nature.

In the report from Chairman Edkins of the Commercial Section it was mentioned that the publications committee had been very successful with its Christmas booklet, having sold 420,000 copies instead of 250,000 as originally planned.

The report of Chairman Bailey, of the Accounting Section, was to the effect that at a meeting of the section executive committee, held on Dec. 6, most of the time was devoted to consideration of the correspondence courses on accounting as planned by the committee on accounting education. A very vigorous campaign will be waged, and it is hoped to have an enrollment of 2000 students in the near future. Three courses will be ready not later than Feb. 1, an elementary course and an advanced course, Part I and Part II.

Chairman McClelland of the Technical Section presented the following recommendation prepared by the sub-committee appointed at the last meeting to consider the advisability of the creation of general information and data files for technical matters: "Your sub-committee recommends that it be authorized to select, with the approval of the president, for this position a man of technical training and detailed experience in all branches of public service utilities—one who is experienced not only with the engineering problems, particularly high-tension transmission systems, but intimately familiar with the needs of the small central station—at a salary not to exceed $5,000 per annum. It is also recommended that this man be selected and active work started as soon as possible." The recommendation was adopted.

Mr. Gibbs described in detail the work of the Geographic Section Committee. He referred to the creation of the new section on the Pacific Coast, including California, Nevada, Arizona and New Mexico, and gave facts with regard to the state of affairs in New York State, Utah, Kansas, Indiana, and the proposed Mississippi group, and Michigan and Wisconsin. An outline was given of the plan by which in composite state associations where the electric companies predominated as to number over the gas companies, such associations should be eligible to membership in the N. E. L. A. and should be represented on the Executive Committee through a central station man. The Empire State Gas and Electric Association was cited as an example which, if affiliated in this way, would also absorb the present Eastern New York section.

With reference to the action taken by the committee at the meeting in October on change in the prospectus to the Constitution and certain changes in the Constitution itself, the president stated that a revised document dealing with the ideals, policies and progress of the association had been prepared and would shortly be submitted in advance proof form, accompanied by

the recommendations of the Committee on Constitution.

The general question of national water power legislation was brought up by Mr. W. E. Mitchell, president of the Southeastern Section.

DEADLOCK OVER DAM BILL

House and Senate Conferees Apparently Unable to Agree on Suggested Amendments

A deadlock exists between the House and Senate Conferees on the general dam bill, according to an announcement made by Representative Adamson of the House conferees last week. It is understood that this deadlock exists by reason of the fact that the House conferees object to the Senate amendments which would invest so much discretionary power in the Secretary of War regarding the granting of permits to build dams across navigable waters. Mr. Adamson announced:

"I have noticed several sensational and spurious reports of interviews with me which I utterly repudiate. Those who oppose water power development are very careless in their statements to try to prejudice the cause, and seem to think it is popular to attack the Shields bill. I have never discussed the Shields bill at all. The Conference Committee has discussed the House substitute in all our meetings, and the Senate conferees have stoutly objected to two features in the House bill, which the House put on by amendment over my vote and objection, but on which I cannot possibly yield. On the other hand, the Senate conferees say they will not yield, and accordingly I have stated to all inquirers that we are hopelessly deadlocked, and we are. Unless the Senate yields on the two propositions, or the House should instruct its conferees to yield there can be no agreement, but all statements that I have made any disparaging remarks about the Shields bill are false."

MOVEMENT FOR EFFECTING INTER-SOCIETY CO-OPERATION

Conference Committee on Co-operation on Technical Subjects Formed to Co-ordinate Work of Societies and Avoid Conflicting Standards

At a meeting called by Peter Junkersfeld of Chicago, at the Engineering Societies Building, New York, on Dec. 15, a plan which has been several times suggested by various associations, began to take shape. This meeting, which is now known as The Conference Committee on Co-operation on Technical Subjects, had as its object the perfection of a method for eliminating duplication in technical work, for eliminating conflicting standards and for supplementing the work of one association by the work of another. It was made especially plain that it is the function of this committee to supplement, not to duplicate, work.

In a general discussion of the purpose and methods of the conference, two general theories were developed. One was that the conference should proceed with the aim of ultimately becoming a strong, permanent organization which should undertake to apportion work between the various engineering associations and should assume general supervision over work of common interest, particularly standardization. The other was that the conference should aim to preserve an informal and temporary status, should act merely as a committee to suggest and encourage the use of means whereby several associations might themselves co-operate more effectively. The general sentiment of the conference favored the second plan.

It was the opinion that at the outset it will be preferable to work only with those associations which are most directly interested and which have hitherto shown the greatest readiness to enter into co-operate arrangements. A report of the committee's action was adopted and this will be presented to several associations which may participate in the movement.

The associations officially represented at the meeting were the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies, the American Electric Railway Engineering Association and the Electric Power Club. The associations unofficially represented were the American Society of Mechanical Engineers and the Association of Iron and Steel Electrical Engineers. The men who represented these societies at the conference were Peter Junkersfeld, I. E. Moultrop, Farley Osgood, G. L. Knight, G. W. Palmer, Jr., A. B. Stitzer, C. L. Collens, II, A. H. Moore, Charles Robbins, H. C. Petty, F. B. Crosby, Prof. C. A. Adams, Prof. F. B. Crocker, H. M. Hobardt, R. J. McClelland and J. E. Moore.

SANITARY DISTRICT SUPPLIES CHICAGO AT TOO LOW A RATE

After Two Years' Investigation, Gardner S. Williams Makes Report Recommending That Interest Be Included in District Expenses

A report issued by Gardner S. Williams to the trustees, Sanitary District of Chicago, states that the district is supplying energy to the City of Chicago for street lighting at a rate below that for making it. The cost to the Sanitary District is stated to be 6.26 mills per kilowatt-hour, while the price paid by the city is 5 mills per kilowatt-hour and $1 per lamp for substation operation. With this arrangement it is claimed the District is losing between $30,000 and $35,000 annually. In other words the district is receiving 5.478 mills per kilowatt-hour while the cost to them is 6.26 mills. The loss is 12.5 per cent.

Bitter controversy exists between certain of the trustees and the city in arriving at the actual cost and selling price of current used for lighting the Chicago streets, operating the garbage reduction plant, pumping stations and other municipal purposes. The one party insists that no interest charge should be made except, perhaps, upon unretired bonds issued to build the hydroelectric plant at Lockport. The other party contends that no interest whatosever should be charged. They argue that it is unfair to require the public to pay taxes representing interest upon a plant for which taxes have already been paid to build it. In this connection the opinion of Mr. Williams, who has issued a report upon the Sanitary District's system after an investigation extending two years is of particular interest. Mr. Williams is of the opinion that interest should be included in the cost or expenses of the Sanitary District.

He says: "In one particular the accounting of a municipal corporation must be entirely different from that of an ordinary private corporation. This fact has been overlooked frequently and the failure to appreciate it has led in many instances to serious misconceptions and expensive mistakes. The fundamental proposition in the case of a municipal corporation is that the capital invested cannot be reduced by contributions from earnings, because the earnings belong to the people and the people have furnished the capital. Hence, if the capital were reduced by payments from earnings it would be equivalent to paying a man with his own money.

"As a further consequence that exists is the fact that

the payment of outstanding bonds of a municipal corporation does not reduce the interest to be borne by the people and charged against its operation, for the money to pay those bonds must come from the people who thereby lose the interest they would otherwise receive upon their money. The proceeds of the tax levied by authority of the act of 1903, having been derived from the people of the district, the plant built therefrom and its product belongs to the people. If the funds so obtained had been left in their hands instead of being taken from them by the tax collector the people would have had the use of them and would have received in one form or another interest upon them. Being deprived of this interest themselves it becomes a part of the annual burden the people bear by reason of the existence of the plant. Therefore in any determination of the cost of service rendered by the plant interest upon the amount so received must be included. . . . As these earnings (of the plant) belong to the people, and if not expended for this construction (extension of the plant) would have to be reduced by an equal amount the sum necessary to be raised by taxation during these years for other purposes, the people are entitled to have interest on these amounts included in computing the burden which they bear by reason of the plant."

HISTORY OF EDISON LICENSEE AGREEMENT OUTLINED

C. L. Edgar of Boston Submits Statement to Massachusetts Gas & Electric Light Commission Giving Details of Agreement

In connection with the street lighting rate arbitration now in progress before the Massachusetts Gas and Electric Light Commission, the Edison Electric Illuminating Company of Boston recently presented an extended review of the license agreement with the General Electric Company and its predecessors, under which the Boston company has paid slightly more than $1,000,000 since 1886 for the use of so-called Edison and successor apparatus.

The statement of the Boston Edison company was prepared under the supervision of President Charles L. Edgar in response to an inquiry by Commissioner Schaff relative to discounts at present allowed the company by the above manufacturer. In view of its bearing upon the history of the development of the various Edison central station companies of the country, the statement is abstracted below.

In the latter part of the 70's, Thomas A. Edison began the experiments which led to the development of the Edison system of incandescent lighting, his purpose being to subdivide the electric light into smaller units instead of being obliged to resort to arc lamps for interior illumination. His success led to the granting of basic patents, including the development of extensive apparatus for distribution service, and included not only the incandescent lamp, but sockets, generators, the multiple system of connection, underground tube equipment, the three-wire system, automatic cutouts, switches, regulators, pressure indicators and other appliances. The most important of these inventions were sustained in the courts.

When the Boston Edison company was organized in 1886 there was but one complete system available for the supply of incandescent lighting and power. The other incandescent systems on the market at that time, and there were several, were so plainly inferior to the Edison system as to stamp them as palpable imitations; court decisions, some of them since that time, have justified this opinion of the organizers of the Boston company.

The adoption of this complete system of electric lighting, however, involved obligations on the part of the local company.

In the early 80's the Edison Electric Light Company, known as the Parent Company, was organized for the purpose of developing the incandescent electric lighting system invented by Mr. Edison. They purchased his patents for the entire United States and adopted the following comprehensive plan for exploiting the business. They first organized four manufacturing companies to produce apparatus under the Edison patents. These were the Edison Machine Works, located first in New York and afterwards moved to Schenectady; the Edison Lamp Works of Harrison, N. J.; Bergmann & Company, New York, and the Edison Tube Works, New York. The Parent Company next organized the Edison Company for Isolated Lighting, which controlled the installation of isolated plants throughout the entire United States, but with certain restricted districts. Finally, the plan contemplated the organization of local illuminating companies in the larger cities, and these companies were to be given all the rights of the Parent Company for central station or for isolated lighting. Street railways were specifically exempted. About fifty of these companies were organized, including New York, Chicago, Philadelphia, Brooklyn, Detroit, Cleveland and Boston. In these cities all the manufacturing companies and the Edison Company for Isolated Lighting relinquished their rights to do business except so far as it related to street railways.

As time passed, the Parent Company either bought out or consolidated the manufacturing companies, and finally all were united in the Edison General Electric Company. In 1892 this company consolidated with the Thomson-Houston Company, its greatest competitor, and the resulting General Electric Company is the leading electric company in America to-day.

TERMS FOR LOCAL ORGANIZATION

The general terms upon which local companies were organized were uniform throughout the United States. They involved the requirement that part of the securities of the local company or their equivalent should be turned over to the Parent Company in payment for exclusive rights in the territory named to the several hundred patents owned by the Parent Company, covering also the sale of isolated plants; the right to purchase the product of the manufacturing companies at fair and equitable prices, these being defined at the time as the prices the manufacturers charged the Parent Company or the isolated company for their product. These prices were generally known as "shop prices." The differential which the local companies received was equivalent to the gross profit which the Parent Company or the isolated company charged their customers for similar apparatus; this was not a fixed amount, and averaged 25 per cent, running as high as 40 per cent in some cases. Other considerations received by the local companies were the advantages of the use of the technical organization of the Parent Company, and, finally, the prestige Mr. Edison's name added to the enterprise.

The Boston Edison company was organized in 1886 under this arrangement, and from its first three issues of stock turned over 35 per cent of the sale proceeds to the Parent Company. The fact that the Edison patents did not control the situation, and that it was possible for companies or individuals to purchase incandescent lamps and dynamos from others, was used later by the Boston company to reduce the percentage of stock given

for license, and from time to time that percentage has been reduced until at present it is 2 per cent upon the amount received from the sale of securities. This would be somewhat over 4 per cent upon the par value, on account of the premium at which the stock has been issued.

Exemptions from License Payments

As the central station business grew, the various local Edison companies either consolidated with or purchased the competing companies in their cities, and in the case of Boston, that portion of the securities issued for the purchase of competing companies was exempted by the Parent Company from the license payments; exemptions were also given for storage batteries, which were not included in the Edison license, as well as for any money expended in the territory covered by the Boston company, but not included within the original confines of the city of Boston. During the past dozen years, therefore, the exemptions have been almost as much as that portion which was not exempted and on which license was paid.

As competition between the Edison and outside manufacturing companies became more severe, the difference between the licensee shop prices and the non-licensee prices became less and less, and, in fact, almost disappeared. It has been impossible to determine just how much the Boston Edison company saved by purchasing its Edison supplies and apparatus under this licensee contract over what it would have paid had it not been a licensee. This amount is certainly hundreds of thousands of dollars, and the management is entirely satisfied that it exceeds the amount that was paid for the license.

When the difference in price between the licensee and non-licensee customers became comparatively small, upon the Boston company's agreement that all bills would be paid promptly, the Parent Company increased this difference by adding an extra or special discount based somewhat upon the amount of license which had been paid. In the Boston case this discount is 5 per cent on everything except incandescent lamps, arc lamps and parts, rectifiers and parts, no discount being allowed on these devices on account of agreement between the General Electric and the Westinghouse companies.

At the time the original stock of the Boston company was issued, and later, the amount paid for the license was included in plant, and capital representing this was issued. The apparatus purchased of the manufacturing companies was charged to the plant account at so-called "shop prices," which were the net amounts the Boston company paid the manufacturers, capital being authorized and issued for this in the usual course.

License Payments Now Made from Earnings

After this plan had been in force for some years, the Boston company changed its policy in regard to capitalizing these licensee payments, and charged off the amounts which had previously been paid, other property being thereby substituted to represent capital issued on this account. License payments since that time have been made from earnings. The amount of the special discount given in consideration of the license has, therefore, been considered as belonging to the customers rather than to the stockholders, and has been put into the earnings rather than used to reduce the cost of the plant, the payment for which is a well-recognized obligation of the stockholders. The company has a constantly accruing obligation in license payments in connection with its continual growth, and the diversion of these discounts from the earnings account to the property account would mean that future license payments must be contributed entirely by the customers, without the substantial assistance which this special discount has heretofore given.

The incidental advantages of the right to do an isolated plant business in Boston and the right to sell incandescent lamps have belonged to the Boston Edison company all these years, though for commercial reasons temporary agreements have been made with the General Electric Company to handle this business. The sale of incandescent lamps and other patented apparatus excepting motors and isolated plants has brought the company a return in the form of royalty from the General Electric Company for a number of years of $1,500 per annum. Some profit has been made from the sale of isolated plants; this latter business is now under the Boston company's control, and its policy naturally is to discourage their introduction wherever possible on the ground that their introduction is an economic mistake and that Edison service can now be obtained at prices which will compare favorably in almost all instances with the cost of operating isolated plants. The mere fact of being able to connect the special discounts directly with materials purchased hardly justifies a different treatment from that given the royalties, etc.

Value of Licenses

It is impossible at this late date to judge what the effect would have been if the Boston company had not entered into the contract with the Edison Electric Light Company; it is inconceivable, however, that the company could have attained its present state of public usefulness without operating under the patents controlled by this company. The invention of the transformer and the discovery of the benefits of alternating current transmission were not anticipated by Mr. Edison, nor were they known at the time the Boston company was organized; the principal effect of these has been to enable the company to extend its supply to much greater distances, but from the substations outward the operation of the system is still dependent upon the Edison patents and developments. Complete systems can now be obtained from other companies than the General Electric, but this was not so in 1886, and the inability to use the Edison system as then developed would have retarded for many years the development of the electric lighting business in Boston. Without the licensee privileges a vastly greater investment would have been required.

The contract of 1886 has not been changed in any particular except as to the amount of the license. Some of its clauses have become valueless with time. As the original patents ran out new ones have taken their places, so that the license has a continuing value, less, of course, than in the beginning, but certainly of too great value to have the license cancelled. The policy of the Boston Edison company is, therefore, to continue its license indefinitely, paying as low a license fee as can be mutually agreed upon. No settlement has been made with the Parent Company for the past nine years, though negotiations have been going on from time to time relative to the further reduction of the license percentage. The latest negotiations look to the Boston company's giving up its isolated plant rights and confining its activities under the license merely to central station business; they may result in a new agreement with this specific change, otherwise the contract is likely to continue indefinitely. From 1893, when the first storage battery was installed, until 1907, when the last license payment was made, the amount paid for license was in every case the result of negotiations, and settlements were often made for lump sums without regard to the exact percentage which this might be upon the cash received from the sale of securities.

Selling 1248 Electric Ranges in Twelve Months

How the Fourteen Divisions of the Southern California Edison Company Worked Together to Raise the Range Load of Their Districts

BY S. M. KENNEDY
General Agent, Southern California Edison Company

CALIFORNIA, and particularly the southern portion of the state, has the reputation of being highly developed from an electrical standpoint. The record of one year's sales of electric ranges by one company will not tend to decrease the reputation already earned.

On the first day of November, 1915, the Southern California Edison Company commenced selling electric ranges in real earnest. Prior to that date there had been sold on the company's system a few score of ranges, without any particular method being followed as to types, makes or manner of sale. Most of the earlier sales had been gradually eliminated for one reason or another until there remained on the date referred to only fifty-nine installations. On Nov. 1, 1916, the total number of ranges installed or contracted to be installed on the Edison system, after deducting all cancellations, was 1248, making a sales record averaging about 100 ranges per month for twelve consecutive months. These results were not obtained by haphazard spurts, but rather from a carefully prepared plan which was enthusiastically carried out. No so-called campaigns were inaugurated to create spasmodic interest and be followed by the inevitable reaction. No sensational or pyrotechnic advertising was adopted to arouse temporary curiosity and later be succeeded by chilling indifference. On the other hand a regular department was organized to carry on the work of educating, promoting, demonstrating and selling every working day of the year.

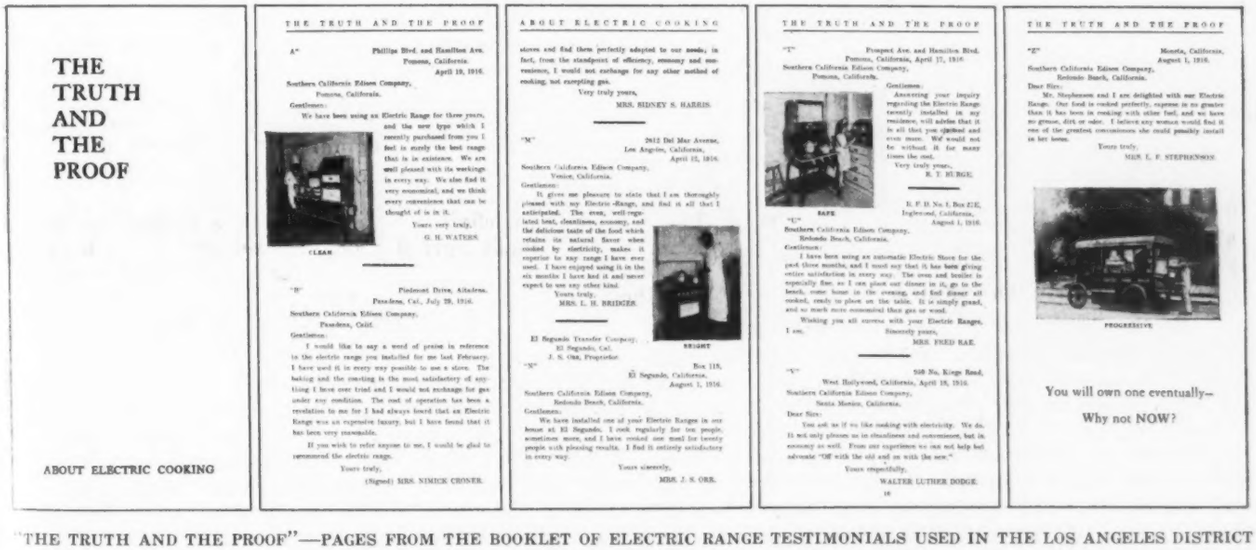
THE SYSTEM IS DIVIDED INTO FOURTEEN DISTRICTS

The system of Southern California Edison Company is divided into fourteen districts, each in charge of a local manager. These districts vary in size and importance, in proportion to population and territory embraced. It is interesting to note that the sales of electric ranges were remarkably well distributed over the entire system, the proportions being as shown in the following table:

District A—A large city	168 Ranges
District B—Residential city of 45,000 population	100 Ranges
District C—Residential city of 25,000 population and rural territory	152 Ranges
District D—City of 20,000 population; agricultural territory	154 Ranges
District E—Residential city of 15,000 population; citrus territory	86 Ranges
District F—Beach resort city	20 Ranges
District G—Beach city and rural territory	43 Ranges
District H—Manufacturing city of 12,000 population and rural territory	49 Ranges
District I—Seaport	10 Ranges
District J—City of 40,000 population; residential and industrial	158 Ranges
District K—Residential city of 10,000 population and rural territory	36 Ranges
District L—Residential city of 10,000 population and citrus territory	109 Ranges
District M—Small city of 2000 population; agricultural territory	102 Ranges
District N—Tourist and residential city of 20,000 population; rural territory	61 Ranges
	1248 Ranges

Gas service is available in all the cities, and in much of the rural territory. Of electric range sales about 40 per cent were made along gas lines and 60 per cent where gas service was not to be had. One hundred and ninety-four ranges were sold for installation in five new apartment houses, all of which could have obtained gas service. Twenty ranges were sold for installation in domestic science departments of public schools. The educational advantages and possibilities of such installations were readily appreciated. A few ranges have been installed in the kitchens of institutions and some in restaurants. The remainder of the ranges, a total of more than 1000, represent installations in an equal number of residences for domestic use.

The selling and installing of a large number of electric ranges in twelve months involves a great amount of labor, because both the selling and installing were com-



"THE TRUTH AND THE PROOF"—PAGES FROM THE BOOKLET OF ELECTRIC RANGE TESTIMONIALS USED IN THE LOS ANGELES DISTRICT

"There are twenty-six letters in the alphabet and in this booklet there are twenty-six letters from customers of the Southern California Edison Company who have learned the A B C's of cooking by electricity."—explains the opening paragraph of this twelve-page booklet, which continues: "It will be noted that the letters are written by customers living in or close to Los Angeles, consequently the writers of these communications may be readily referred to by letter, telephone or personal inquiry." Note the electric range delivery wagon pictured on the last page.

paratively new work, and men had to be educated to do both in the right way. The company quickly learned that if it desired to make sales in quantities it must secure expert salesmen who could make reasonably good incomes. Six men were finally selected to give their entire time to electric cooking contracts. They were paid both salary and commission, and soon became enthusiastic advocates of and sound believers in the utility of the electric range. Some of these men averaged one range per day for several months, and others sold an average of three or four ranges per week right along. The most effective work in selling electric cooking service cannot be done by men who must divide their time selling lighting and power service also. The company's range salesmen working in rural territory were provided with automobiles. This increased their efficiency by enabling them to make more calls per day. The cars also permitted the salesmen to take prospects to visit installations already made or to inspect the various types of ranges in the company's salesrooms. It often happened that numerous calls on the same prospect had to be made, and frequently both husband and wife required to be convinced before a contract was finally closed.

To obtain the desired results salesmen must be enthusiastic, diplomatic, persistent, systematic and, above all, have absolute faith in the proposals they make and the service they are selling. The company's new business manager and his assistants found it desirable to hold frequent and regular meetings with range salesmen, to instruct and educate the men and direct their operations, and these meetings were always productive of good results. Demonstrations are invaluable, but few salesmen can cook or demonstrate, and moreover women are not always interested in men cooks, as some think such men are usurping women's prerogative. The Southern California Edison Company found it important to have good female demonstrators—first, to give exhibitions in the company's offices and, second, to visit purchasers of electric ranges in their homes and show them how best to handle the ranges, in order that the most satisfaction could be obtained at the least expense. The successful operation of an electric range department cannot be carried on without demonstrators who not only know how to cook electrically, but who know whether the range and the service supplied to each range are what they should be to do proper work. The most useful demonstrator must also be a diplomat. Many women are sensitive about criticism of their kitchens and the manner in which they are run, and the demonstrator must persuade rather than dictate. The Edison Company now keeps two lady demonstrators who are constantly at work. Each one is supplied with a light automobile and a large portion of their time is spent in nursing installations already made. The salesmen soon found that a pleased electric range consumer becomes an ardent advocate of electric cooking among friends and neighbors. Consequently, future contracts were obtained with less trouble in localities where one or more ranges were being used with satisfaction.

Ample Stock Essential to Prompt Sales

It is a difficult matter to make sales without a stock to draw upon. Catalogs are excellent, but the goods are better. The company has maintained a liberal stock of various types of ranges of several standard makes. By this means stoves could be shown at once to fit all needs, conditions and purses. A prospect may take several months to make up his mind to buy an electric range, but usually he would like to have it installed the day after he signs the contract. Sometimes delays in obtaining stock and consequent delays in installations mean cancellation of orders. The Edison company has kept the selling prices down as low as possible in order to make them attractive, and has in most cases agreed to do the work of installing, including the fuel run from the meter to the range, for a flat rate of $10. The company has been satisfied to break even on the installations—and has not looked for any profit in that direction. High prices tend to restrict sales and low prices increase their volume.

The arousing of interest in electric cooking and creating a desire for information among consumers requires good advertising. The Edison company has used liberally the newspaper, the folder, the follow-up letter and the testimonial—all with more or less effect. The follow-up letter is the best medium to prepare the way for the salesman, and after the salesman first calls the testimonial from actual consumers is of great value. The company has recently issued a folder entitled "The Truth and the Proof About Electric Cooking." It contains twenty-six letters from consumers of the company who have been using electric ranges in their homes for some time. These letters were selected from many of a similar character, and they deal with all phases of electric cooking, and there is no objection to the use of the electric range which is not met and offset in one or more of the testimonials. The letters in question were all written by consumers of the company with whom prospects may easily communicate by mail, telephone or personal inquiry. The illustrations were all taken in the kitchens of satisfied customers.

Combination Lighting and Cooking Service Schedule Used

The Edison company has adopted a combination schedule for lighting and cooking service which has been very satisfactory to the company and its customers. This schedule provides for one service and one meter in each residence. This method tends to keep down investment and operating costs as well as eliminating confusion and trouble for the consumer. The schedule is as follows:

For all consumption of electric energy in residences and suites of apartments, through one meter, where an electric range is installed and used for cooking purposes:

Class A—Houses of eight active rooms and over, first 40 kw.-hr. per month, 7 cents per kilowatt-hour.

Class B—Houses of six and seven active rooms, first 30 kw.-hr. per month, 7 cents per kilowatt-hour.

Class C—Houses of five active rooms and less and apartment house suites, first 20 kw-hr. per month, 7 cents per kilowatt-hour.

For all energy used in excess of the number of kilowatt-hours per month designated in any of the above classes, 3.5 cents per kilowatt-hour.

Monthly minimum bill $2.50.

In classifying the houses supplied with service under this schedule bathrooms, halls and cellars will not be included as active rooms.

The foregoing schedule applies in all territory except in the two largest cities on the company's system. In these cities, because of local regulations, a special meter is set for cooking service, and charge is made on a regular power schedule.

Water Heating Business Now Actively Solicited

The company is now proceeding energetically to develop the water heating load, particularly in rural territory where gas is not available. Experience has demonstrated that the average consumption of the electric cooking consumer is 100 kw.-hr. per month. To provide for the additional water heating load another block has been added to the combination schedule, which would work out as follows for a consumer having, for example, a seven-room house: First 30 kw.-hr. per month (lighting), 7 cents per kilowatt-hour; next 100 kw.-

hr. per month (cooking), 3.5 cents per kilowatt-hour; excess of 130 kw.-hr. per month (water heating), 2 cents per kilowatt-hour. It is expected that the water heating load will average about 150 kw-hr. per consumer per month. This average consumption for water heaters would naturally be exceeded in colder climates. The water-heating schedule is only given where an electric range is installed and used for cooking and an electric water heater is installed for heating water. Further, in order that a consumer may obtain this water-heating rate of 2 cents per kilowatt-hour, the service must be controlled by a double throw switch so that when the range is on the water heater is off and vice versa. This rule makes the same service meter and transformer installation on the range take care of the needs of the water heater. It also prevents the range and the water heater from being on the peak at the same time. It is expected that the solving of the water heating problem for rural customers will pave the way for many additional installations of electric ranges. Frequently a prospect would refuse to adopt electric cooking because, for hot water purposes, he needed his old equipment and did not wish or had not room enough for two stoves in his kitchen. An electric water heater attached to the old water tank will eliminate the coal, wood or oil-burning range.

The Southern California Edison Company has had the co-operation and assistance of the principal electric range manufacturers in the exploitation and promotion work and the soliciting for electric cooking business. In most cases the electric dealers and contractors have also recognized that in the present stage of electric cooking the central station must bear the strain, as the expense is necessarily heavy and no other branch of the industry could afford to spend the time and money for the development of this new business. The profitable period for the dealers will come later, when the real demand has been created. The management of the Edison company has encouraged the use of electric ranges among its own employees, and has endeavored to educate all employees to appreciate the utility of electric cooking for its own sake, and also to understand its value as an income producer for the company. It is confidently expected that the 1917 sales of electric ranges will be 50 per cent greater than those of 1916, unless the higher prices have a depressing influence upon the anticipated demand. The methods to be adopted during the coming year will be much the same as those followed in the present year, but owing to the excellent promotion work already done the results should be more satisfactory.

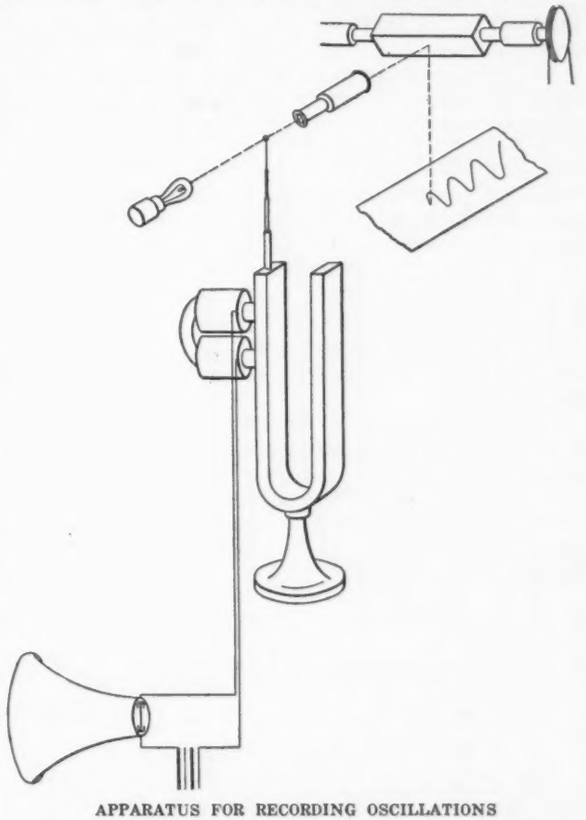
High Value of Scrap Metal Used as Argument for Change to Central Station Service

In a folder stating that scrap copper has increased in value more than 85 per cent, that scrap iron has risen 40 per cent and that other metals have shown corresponding increases in value, the Commonwealth Edison Company, Chicago, makes an effort to interest isolated plant owners in central station service.

"This is the time to get rid of your power plant," says the folder. "We are going through a period when metals such as copper and iron have risen remarkably in value. Extraordinarily good as these prices are today, there is little likelihood of their remaining at their present mark. Owners of power plants ought to find this an advantageous moment to dispose of those plants at exceptionally high prices, utilizing the space for other purposes. New power plants are higher in price than ever, for the same economic reasons that have boosted the second-hand and scrap value of old plants. Edison service has improved in quality but has not increased in cost. In fact, its cost has decreased and, in accordance with the policy of the Commonwealth Edison Company, it will probably continue to decrease. It should prove an immediate, as well as an eventual, financial gain, to dispense with a privately-operated power plant and install economical, reliable Edison service now."

A Tuning-Fork Recorder of Complex Wave Forms

Hitherto, by impressing upon an electromagnetically controlled tuning fork an alternating current of complex wave form the fork itself only responded to the fundamental and wholly disregarded the higher harmonics impressed upon the electromagnet. By



APPARATUS FOR RECORDING OSCILLATIONS

means of suspending a ball member at the end of a series of graduated supports attached to each other in abutting relationship, Alexander Behm of Kiel, Germany, in patent No. 1,203,172, has been able to produce a tuning-fork oscillator which can be made to record not only the fundamental of a complex wave form but also any one or a series of harmonics present in the wave. Moreover, by suitably calculating the dimensions and the ratios of oscillation of the separate members of the combination, it is possible to insure that the measuring member shall come to rest again within a period of 0.02 seconds in spite of having made a large deflection. This strong damping is brought about not only by the increased air resistance due to the greater length of surface, but chiefly by the vibrations which the separate members perform relatively to each other. Thus the improved tuning fork is admirably adapted within its range for recording speech wave forms either by the aid of a microphone amplifier or even directly by means of a diaphragm.

What Co-operation Means in Foreign Trade

Federal Trade Commission, Favoring Combinations for Foreign Commerce, Shows That the American Electrical Industry Has to Meet Powerful European Competition

AFTER an extensive investigation of competitive conditions affecting Americans in international trade the Federal Trade Commission favors legislation to permit co-operative export organizations of American producers and manufacturers. The commission approves the principle which it was sought to embody in the Webb bill, already passed by the House of Representatives and now awaiting action by the Senate. Its recommendation is "subject to the condition that the legislation shall be carefully safeguarded and shall make absolutely clear that the combinations for export business are subject to all the rigors of the Sherman law if they are used to restrain trade in the United States."

An abstract of the account of the conditions prevailing in the electrical industries of Germany and England, as presented in the report of the commission, follows:

Communities of Interest in Germany

The Allgemeine Elektricitäts-Gesellschaft and the Siemens-Schuckert have succeeded in concentrating about 80 per cent of the entire electrical business of Germany into their own hands. Of this about 45 per cent is controlled by the A. E. G. and about 35 per cent by Siemens.

One of the distinctive features of the German electrical industry is the extent to which it is supported by banks.

Through members of its board and executives, the A. E. G. is related to banks and banking groups representing $533,234,000. [These relationships are graphically shown on a chart prepared from data submitted by William J. Clark of the General Electric Company and arranged according to a design suggested by O. C. Merrill of that company, and published in the report.]

This close connection with great banking groups has assisted the A. E. G. in the promotion of foreign trade. These banks have assisted in financing many foreign undertakings in which electrical equipment was required. They have also assisted in the organization of special banks and trust companies for electrical enterprises, preferably abroad.

These banking connections also account for the credit extended in foreign trade by the A. E. G. and the Siemens-Schuckert concern.

The chart also shows the extensive connections of the A. E. G. with other important German business enterprises. Some of these, such as insurance companies, add to its financial strength. Others are companies manufacturing chemicals, glass, fabrics of various kinds, iron and steel products, etc. Others are mining companies, metal buying and refining concerns. These all facilitate its purchase of materials and supplies. Still others are transportation, light, power and public-utility companies.

The A. E. G. maintains a most extensive organization throughout Germany and many foreign countries by means of subsidiary companies. Some of these are banks for the financing of electrical enterprises; others are operating, managing, and selling companies. All in all they represent a capital investment of approximately $500,000,000.

Agreements Covering Foreign Markets

In 1903 the A. E. G. entered, it is said, into an agreement with the General Electric Company of America by which certain territories are respected. The A. E. G. was given the exclusive trade in Germany, Luxemburg, Austria-Hungary, European and Asiatic Russia, Finland, Holland, Belgium, Sweden, Norway, Denmark,

SECRETARY REDFIELD SAYS FOREIGN TRADE MAINTAINS DOMESTIC BUSINESS

W. C. Redfield, secretary of the Department of Commerce, states to the ***Electrical World:***

"Our experience in the Department of Commerce shows us that the electrical manufacturer has a vital interest in the development of export trade.

"We must have foreign trade if we are to maintain our domestic business. To-day we hold the world's greatest reserve of gold. This reserve forms the basis for all our credits, domestic and foreign, those we grant at home and those we grant abroad. Unless we have a great gold reserve we cannot grant credits largely. Large reserve means large ability to grant credits; smaller reserve, less ability, and a very small reserve means small ability to grant credits anywhere, at home as well as abroad. If, then, in coming times other nations shall draw too heavily on our gold reserve, the volume of our domestic credits must shrink. It will not, in other words, be as easy, perhaps not easy at all, to get sufficient credit to keep our domestic industries moving as we wish.

"There are several ways to protect this gold reserve: loans abroad, investments abroad, sales abroad. These are three most effective. Probably all of them will be needed. Certainly all of them should be encouraged by every far-seeing American business man. The manufacturer who says he does not care for foreign trade is following false lights. If all did that our domestic trade would soon shrink. We must keep out in the big world whether we will or no in order to keep on good terms with ourselves in our domestic world. Foreign trade is not a luxury but a necessity. Our plants are too big to run full time continuously on our domestic market. We may not offset the foreign trade against the domestic. We must rather remember that one should be done and the other should not be left undone.

"Appreciating these facts the Department of Commerce aims to help the foreign trade in every practicable way. It has a double staff of trained commercial men, ten commercial attachés who hold fixed posts, and twenty or more commercial agents, who are traveling men. The results of their work and that of our fine consular service are made known to the business world through eight branch offices and eight co-operating offices and by constant publications, including a daily paper, 'Commerce Reports,' and through the correspondence and circular letters of the main office in Washington. Our commercial staff, both foreign and domestic, is kept in constant personal touch also with manufacturers and commerical bodies throughout the country. The service is flexible, effective, productive. It has the enthusiastic support of the business men who have tried it. It produces in actual orders many-fold its annual cost each year. We think it to-day the most effective official apparatus in aid of industry that there is anywhere. Still it may be improved, and if business men will use it and will constructively criticize it they will help both themselves and us."

Switzerland, Turkey and the Balkan States, while the United States and Canada were apportioned to the General Electric Company. In addition, the A. E. G. was given the right to use the Curtis patents for steam turbines and the General Electric Company that of the Riedler-Stumpf patents. This agreement, however, binds only the General Electric Company, and other American concerns were not parties to it. The neutral districts, which are open to both, are said to be Mexico, Central America, South America, and Japan.

A. E. G. AND SIEMENS-SCHUCKERT GROUPS

As in the case of the A. E. G., the Siemens-Schuckert group is closely connected with powerful banking groups which aid in promoting its business. Considering the Siemens-Schuckertwerke and the Siemens-Halske A. G. as an entity—the Siemens-Schuckert concern—and eliminating duplication of connection with the Deutsche Bank, the Essener Kredit-Anstalt, the Elektro-Treuhand A. G., and the Reichsbank, it appears that German banking interests aggregating $300,000,000 support the organization.

By some authorities it is said that the A. E. G. and Siemens-Schuckert concerns are in sharp competition throughout Germany and in many other parts of the world. On the other hand, various Americans who are well informed as to the conditions of the electrical industry of the world state that in foreign trade at least there seems to be little or no competition between them, but that frequently they operate jointly. It has also been said in Germany that there is more or less agreement between the two and that for several years they have not been unlimited competitors, but that the chief staple products of the two groups have been sold on the basis of a fixed schedule, all larger products, oversea as well as domestic, being handled according to mutual agreement, frequently on common account.

BRITISH INVESTMENTS AND CO-OPERATION

British investments in foreign public service or utility corporations related to or dependent upon the electrical industry, not including the United States and Canada, are in excess of $1,000,000,000.

The British organization and control of these undertakings is reflected in the British export trade, for British factories are the chief feeders of these consumers of electrical goods. It is but natural that contract specifications dictated by British executives and engineers call for British or British-standardized equipment and supplies.

EFFECTIVE BEAMA ORGANIZATION

In the export of electrical supplies and equipment British manufacturers co-operate in a comprehensive and effective organization, the British Electrical & Allied Manufacturers' Association.

The avowed activities of the association are directed toward fostering and protecting the electrical and related industries in Great Britain through co-operative action. The association further provides machinery for the prosecution of claims before the government, municipal corporations, and the board of trade, and against common carriers. Government bills and home office regulations affecting the electrical and allied industries receive prompt and practical attention.

Conferences have been held with British colonial authorities respecting tariff measures. Overseas committees in the colonies and in foreign countries have been appointed, and the efforts of these committees have been directed along practical lines—such as reports on (1) the chief handicaps to British trade, susceptible of removal through the exercise of influence on or through the government, whether of the United Kingdom or of the country under consideration; (2) the chief shortcomings of British manufacturers in such connections as price, deliveries, design, behavior of plant, etc.; (3) the success of methods employed by foreign competitors, with a description of them and recommendations flowing from such investigations. The central office in London also acts as a clearing house for information in regard to important tenders in the export field.

CO-OPERATION AMONG AMERICAN MANUFACTURERS

Under prevailing conditions it is not profitable for smaller concerns to maintain independent selling organizations abroad, however efficient individually that representation may be. The individual or specialty manufacturer, however ably represented in his line, obviously would hesitate, and probably would be unable, to bid with safety on a whole contract. His better prepared foreign competitor, with a widespread organization at his back, would not be affected by similar limitations. In the cases of the General Electric Company and the Westinghouse Electric & Manufacturing Company there is little, if any, inferiority, as compared with their foreign competitors so far as industrial combination affects their efficiency.

Co-operation of American electrical manufacturers would permit the joint financing of many foreign enterprises in which such financing must be done to secure the business. Moreover, it would permit the extension of credits, where necessary, to compete with the credits offered by foreign manufacturers.

In seeking the removal of restrictions or obstacles to freer trade in American goods, in propaganda favoring the adoption of American standards and designs by governments and others, and in education abroad touching the merits of American electrical products, united action would be invaluable.

MONOPOLIES IN CERTAIN LINES IN GERMANY

A special report by Julius G. Lay, United States Consul General at Berlin, dated Nov. 2 to 16, 1915, is included among the various reports which were received by the commission in connection with its investigation. In part this report refers to the electrical industry as follows:

In certain lines there are occasionally absolute monopolies. For instance, the Vereinigung deutscher Starkstrom Kabelfabrikanten is a cartel for high-tension cables. The contract runs until 1917. This cartel is composed of Bergmann, Siemens-Schuckert, Felten & Guilleaume, A. E. G. and Süddeutsche Kabelwerke, and is an absolute monopoly. Also Akkumulatorenfabrik Berlin u. Hagen is a monopoly of the storage-battery manufactories. Siemens, Halske, and A. E. G. have bought up about thirty different storage-battery manufactories, leaving only one outsider, the Accumulatoren und Elektricitäts Werke A.-G., formerly W. A. Böse. The monopoly pays 25 per cent dividends.

The lamp business, which is of great importance, is the main field for sharp competition between the firms A. E. G., Siemens-Schuckert, Bergmann, and the Auer Gesellschaft (which makes only lamps, both gas and electric). However, patent conventions exist between these companies and between each one of them and the General Electric in America. Altogether, there are eleven competitors making metal-filament lamps.

The German electrical concerns in European countries have their own foreign company; in South America they have their own company in the principal cities, but in some cases have agents to whom salaried engineers from the home office are accredited and paid by the home office. The A. E. G. alone has 100 offices in continental Europe outside of Germany and sixty offices outside of Europe.

MAXIMUM DEMAND RATES FOR LARGE DOWNTOWN BUILDINGS

Data Collected to Show That Maximum Demand Rather Than Connected Load Should Be the Basis for Electric Service Rate

BY W. P. WHITTINGTON
Springfield (Ohio.) Light, Heat & Power Company

Hotels, department stores and office buildings constitute three desirable classes of central-station business; this is especially true when they are considered from the standpoint of the co-relative effect upon the plant load characteristics. Any of the three when considered individually, however, possess "freaks" of load and demand character, which by some are considered objectionable. The principal objection is the comparatively small number of hours' use of the connected load. This probably has been the predominating cause for the failure of a great many central-station companies to make rates sufficiently attractive to displace isolated plants in buildings used for these classes of business.

Upon noting the comparatively few active smokestacks on the newer buildings and the predominance of them on the old buildings, it would appear that the rates for this class of business have attained that "stand-still" stage wherein two unfortunate conditions prevail. First, the owner of the new building feels that he is not justified in making a plant investment without first giving central-station service a fair trial. In fact, consulting engineers are advising that very thing to-day. One engineer stated that he advises this procedure (in some instances even when he is fully convinced that the owner can produce his own light, power and heat at a lower cost) for the reason that he will have the actual metered data relative to the operating characteristics to assist him in the design of the most efficient isolated installation. Second, the owner of the isolated plant, with his investment already made, cannot be made to discard his old equipment without positive assurance that doing so will effect a sufficient saving to justify enhanced self-esteem as regards his good business judgment.

Here are two conditions, both of which are detrimental to the central station; under the first named it is as a rule comparatively easy to secure the business, but usually for short-term contracts only, which constitutes an unhealthy growth, a high service cost to the central station, and also a perpetual sales cost. The second condition is the cause of the first; therefore by eliminating the last named condition the first would be eliminated also. How can this be accomplished?

First, it is essential that proper distinction be made between the building with an isolated plant and the building without one. Ordinarily, central stations class them both as prospective buyers of service. But in addition to being a prospective buyer of service, the isolated plant is a competitor, selling electric service to its tenants. There is no doubt whatever but that this competitor can be eliminated and the business secured at a profitable rate if that rate be properly constructed.

All progressive authorities in rate making admit the weakness of the so-called block or quantity rate. It fails in every way to accomplish the ultimate objective, the "straight line on the log sheet." Furthermore, it is not equitable. The alternative chosen by a great many is the connected or active load basis as the determining factor of the ultimate cost per unit to the consumer, either as a basis for a fixed charge in addition to the rate per unit, as a basis for establishing a minimum charge for service, or as a basis for a secondary or tertiary charge in excess of certain hours' use.

There are several objections to this method, chief of which is its tendency to restrict the expansion of the connected load. Again, the influence exerted by the connected load in buildings of this character upon the station demand cannot be determined as can that of the small store located entirely upon the street floor, where the connected load practically constitutes the maximum demand. Consequently, it bears no relation to the necessary plant investment.

To substantiate this contention data was gathered from companies operating in several of the principal cities of Ohio, Illinois, Indiana and Michigan, relative to the load, demand and operating characteristics of the representative hotels, department stores and office buildings connected to their lines. Out of all reports received there were but five buildings in this class wherein the yearly maximum demand is measured; two hotels, two department stores and one office building. The summary given in the table is illustrative of the inconsistency in the relationship of the connected load to the maximum demand.

The data in the accompanying table on the hours use of the connected load and the maximum demand point out very clearly the necessity for using the maximum demand as the governing factor in the calculations for rates for this class of business, if central stations wish to secure it and retain it on a profitable basis, and at the same time compel each class of business to bear its own proportion of the fixed charges. It will be noted that the average hours use per day of the connected load in hotels is only 4.97, but the average hours use per day of the maximum demand is 10.82; in department stores the figures are 4.19 hours and 8.12 hours respectively; and in office buildings the figures are 2.51 hours and 6.60 hours respectively. These data become more striking when considered with the fact that few industrial power customers are using their maximum demand nine hours a day even 200 days per year. Furthermore, the larger industrial power users are, as a rule, located in the outlying districts where serving them entails high plant investment and distribution costs. On the other hand, the hotels, department stores and office buildings are usually situated in that district where the highest proportionate plant investment is already made, and where central stations should put forth the greatest inducements to secure all available, profitable business conducive to complete saturation. It would seem, therefore, that these data should be given due consideration in fixing rates for electrical service in business of this sort.

DATA ON HOURS' USE, CONNECTED LOAD AND MAXIMUM DEMAND BY BUSINESS BUILDINGS

Installations	Hotels		Department Stores		Office Buildings	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
Connected lighting load, in kilowatts	68	53	184	100	9	20
Connected power load, in kilowatts	51	61	238	146	75	69
Yearly kilowatt-hour consumption (light)	160,424	combined	413,467	380,343	10 755	46,127
Yearly kilowatt-hour consumption (power)	177,720	89,987	119,308	63,090	63,690	38,103
Yearly maximum demand	78	25.3	238	120	?	35
Hours use per day of connected load	7.79	2.16	3.45	4.93	2.43	2.59
Hours use per day of maximum demand	11.88	9.76	6.13	10.11	—	6.60
Number of rooms	222	127	—	—	152	137
Number of floors	9	5	7	5	10	12
Cubical contents	941,975	1,276,710	2,176,105	1,795,200	455,490	1,276,710

Straightening Consumers' Load Curves

Industrial Electric Heating Applications Which Take Advantage of Low Unit Rates for Energy Consumed During Off-Peak Periods

BY J. E. BULLARD

THE sale of electricity for heating purposes offers great possibilities for making the load curves of industrial consumers approach straight lines. In practically every industrial plant there are heat requirements. In most of them part or all of these requirements can be met more satisfactorily by electricity than by any other heating agent. Heat requirements differ from light and power requirements in that it is not usually so necessary to use heat at certain fixed periods of the day, regardless of how much this use will increase the peak load. This fact ordinarily makes it possible to use the heat at times when other electrical demands are comparatively low.

Heat also differs from light and power in that, for low temperature requirements, it can be readily and economically stored until it is needed for use.

A system of house heating which has been experimented with abroad and which could be adapted with advantage to many an industrial consumer's premises is that of installing a thoroughly insulated water tank in some convenient elevated place, such as an attic, equipping this tank with electric heaters, operating

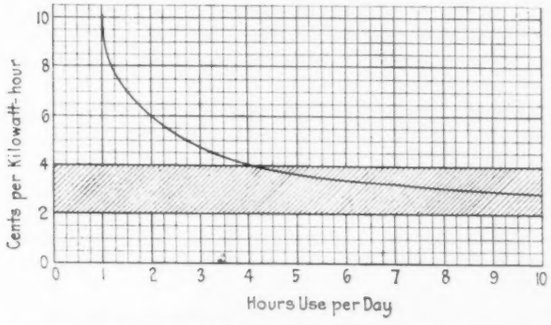


FIG. 1—RATE CURVE SHOWING THE DIFFERENCE BETWEEN THE OFF-PEAK HEATING AND AVERAGE RATE PER KILOWATT-HOUR

these heaters off the peak and pumping the hot water through the heating system to the points where and at the times when heat is required. By operating this system under pressure the temperature can be held considerably above 212 deg. Fahr., provided the heat requirements are not too great and the intervals between the applications of the electric heat too long. For instance, if the system is operated at a pressure of 52 lb. or over per square inch, the temperature of the water can be raised to 300 deg. Fahr.; that is, it permits the operation of the system at a temperature above that at which water boils when exposed to atmospheric pressure. Heat stored in this way can be used for all purposes requiring low temperatures, as heating glue pots, drying kilns, rooms, etc.

INCREASED USE AT LOWER UNIT RATE

It is now common practice to sell electric current to large consumers, and in many cases to small consumers, on a maximum demand or a readiness-to-serve rate. The curve of such a rate is shown in Fig. 1. This particular rate has a readiness-to-serve charge of $2 per month per kilowatt of maximum demand and an energy rate of 2 cents per kilowatt-hour consumed. It is obvious that if a consumer buying electric service under this rate can increase his consumption without at the same time increasing his maximum demand he will have to pay only 2 cents per kilowatt-hour for the increased consumption.

No industrial consumer has a 100 per cent load factor. Even pumps that run night and day have to be occasionally shut down for repairs and, moreover, at times when they are not shut down changes in conditions may effect a temporary change in the load. Load curves in industrial plants are, therefore, much more likely to appear as the one shown in Fig. 2 than they are to be straight lines. The curve shown in Fig. 2 would earn a rate of about 4 cents per kilowatt-hour under the rate shown in Fig. 1, as is indicated by the upper horizontal line in Fig. 1. The shaded portion above the load curve shown in Fig. 2 shows the area in which electric heating can be used without increasing the demand charge.

In other words, it indicates the amount of electric heat that can be purchased at 2 cents per kilowatt-hour. A corresponding area is also shaded in Fig. 1.

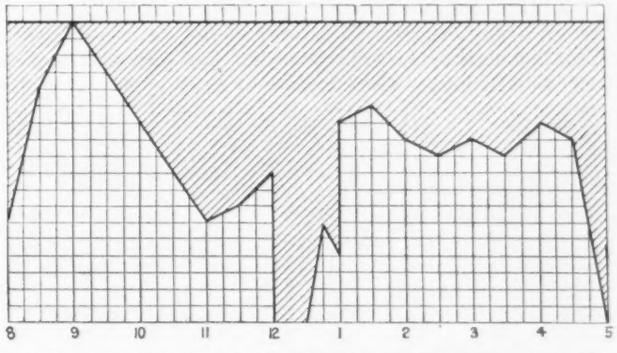


FIG. 2—LOAD CURVE. SHADED PORTION SHOWS WHEN AND HOW MUCH ELECTRIC HEAT CAN BE USED WITHOUT INCREASING THE DEMAND CHARGE

All the current used in this area can be considered as costing only 2 cents per kilowatt-hour, or as resulting in reducing the total cost of current per kilowatt-hour. If all the shaded portion could be filled in with an increased consumption the total kilowatt-hour cost would be reduced to 3 cents. Should the remainder of the twenty-four hours be filled in with a load which remains constantly equal to but does not increase the present demand, the total cost per kilowatt-hour would be reduced to 2.27 cents.

EXPLAINING THE OFF-PEAK RATE TO THE CUSTOMER

Managers of industrial plants are always glad to have this point made clear to them. There are many power users who are hesitating about adopting electric heat simply because they are paying what they consider a rate which prohibits the use of such heat. As soon as it is pointed out to them that they can use their enameling ovens, for instance, at periods of the day which will not cause them to increase the present maximum demand, and that when they are so used the actual cost of current will be only the consumption charge (in the case of the rate used for illustration only 2 cents per kilowatt-hour), they immediately take a far greater interest in the electric heating proposition.

Before the electric heating salesman takes these points up in any great detail with the power consumer, however, he should gather all the data he needs to plot curves similar to those shown here. The rate curve shown in Fig. 1, as well as the lower horizontal line, can, of course, be plotted at once from the rate at which the current is sold. The upper horizontal line can be found by dividing the total monthly bills by the kilowatt-hours consumed and taking the average for several months.

The best way to arrive at the curve shown in Fig. 2 is to plot the daily load curves of the consumer for a number of days. In most cases at least a month's record should be used. These curves can all be plotted on one sheet or on several sheets if transparent paper and the same scale is used. The upper outline of the mass of curves should be ruled in heavier than the rest of the curves. If several sheets have been used make this outline heavy enough so that it will show through the other sheets, then place the sheets one above the other so that the ordinates coincide and rule in the top outline of the complete mass of curves drawn. The resulting curve which might be made on a clean sheet will be one which will show at what periods of the day electric heating can be used without danger of increasing the demand charge. It will also show how large a heating demand it will be safe to recommend to the consumer without increasing his maximum demand.

Avoid Possible Peaks

If this curve is based upon the load curves of too small a number of days there will be serious danger of making heating installations that will overlap the peaks of certain days. The number of daily curves it will be necessary to consider will be determined to a very considerable extent by the nature of the manufacturing done. It is evident that in a factory where the same class of work is done day after day and all operations are thoroughly standardized it will not be necessary to consider as many days as will be the case in a factory where the work is more diversified and the peak load differs to a greater extent, both as regards its height and the time of day at which it occurs. In most cases a month's daily load curves plotted on curve sheets and a study of the factory conditions will demonstrate whether or not it is possible or safe to suggest to the power user that he can use electric heat in considerable quantities without increasing his demand, and that on this account he will earn a low heating rate.

Such suggestions made before a very careful study of the working conditions is made are pretty sure to cause misunderstandings and trouble for the salesman and the central station he represents.

After the maximum demand load curve has been plotted it is time to make a very careful survey of the use of heat in the consumer's plant. It is also time to determine upon the best plan of applying this heat. In most factories there will be found uses for electric heat in performing work that is now done without the agency of heat. For instance, spot welding can be substituted for rivets, and butt welding can be substituted for the practice of fastening the ends of wire together by twisting, as in making wire hoops. A study of the building's heating conditions may also develop the fact that during certain periods of the year it will be possible to economically heat the factory and the offices through the medium of water that has been electrically heated at night in the manner mentioned above. There are periods in the fall and the spring of the year when it is extremely expensive to operate a coal-fired heating system to supply the small amount of heat required. If the factory is not heated, however, the efficiency of the workers falls off to a very marked degree. After it has once been brought up to the desired temperature, the heat generated by the machinery added to the higher outside temperature maintains the inside temperature at the desired point.

Heating Requirements, Obvious and Otherwise

All heating requirements such as these that have just been mentioned which, at first sight are not so apparent, should be considered as well as those where the present use of coke, oil, or gas makes them obvious. When all the heating requirements, together with their individual demands and the length of time the heat is required have been ascertained, plot curves for each requirement and try superimposing them upon the maximum demand curve. All curves so superimposed should be made to fall well within the portion of the curve sheet that is shaded in Fig. 2. After this work has been completed and the cheapest periods for using the electric heat have been ascertained is the time to go to the power consumer and talk business. After the average consumer understands what the salesman has done for him he will be more than merely interested. He will be keen to learn more about the proposition, and will at least consider the possibility of using the electric heat only at such periods as will permit of its use without increasing the demand charge.

An advantage of securing electric heating business in this way, wherever it can be so secured, is that no special heating rates are required. Another advantage is that it reduces the average price per kilowatt-hour paid by the consumer. Perhaps the greatest advantage, however, is the fact that the procedure outlined above is likely to result in a much larger heating load than could be developed by approaching the consumer in the first place with a special electric heating rate rather than on the basis of reducing the present rate that he pays for light and power.

Developing Small Heating Loads

This system also makes it possible to develop many small heating loads which would not prove profitable to either the central station or the consumer if special meters, service wires and transformers had to be installed for them. One precaution, however, which it often will be necessary to take wherever a heating load is developed in this way, is to install time switches that will prevent the use of heating current during the periods of the day when its use would increase the maximum demand of the plant.

In working up electric heating loads as well as any other electric load it should always be borne in mind that the electric man knows a great deal more about electricity and what can be expected of it than does the prospective consumer. Unless the proposition is very carefully and very plainly explained to him from his own point of view the consumer is pretty sure to gain erroneous impressions. After the proposition has been made so clear that the installation has actually been made every precaution should be taken to make it come up to the expectations of the consumer. Very often time spent in giving special attention to the installation in the interest of the consumer after it has actually been put into operation will prove as valuable as, if not more valuable than, the same amount of time spent before the contracts are signed. The writer has seen these facts so often substantiated by the securing and holding of business after it has been given up as hopeless because the central station once had it and lost it, due to the lack of attention paid to the consumer, that he wonders why all central stations and central station salesmen do not put them into practice.

EFFECT OF MINING BOOM ON GALENA (ILL.) STATION

How the Rise in the Zinc Market Price Increased the Demand for Energy and How the Galena Company Met the Situation

When the market price of zinc jumped from $60 a ton to $130 in the early months of the war, old mines around Galena, Ill., began working two shifts a day. Five new mines sprang into existence, and prospectors flocked to the district and began drilling. This mining boom presented a serious problem to the Interstate Light & Power Company of Galena, for practically all of the mines were operated by electricity. The increased demand came on so suddenly that it was practically impossible to install new machines rapidly enough to keep ahead of the load, which jumped from a peak of 3500 kw. to 6500 kw. in a little more than a year. Promises of early deliveries in new generating equipment could not be secured, it being only by good fortune that the company was able to pick up a 2500-kw. General Electric unit on which the original order had been cancelled. This machine was installed and running in a little over ninety days.

Just before this machine was ready to start up, however, the situation was further complicated by the burning out of a 2000-kw. turbine generator then in use. Despite this accident the company proceeded to carry all the load it could with the remainder of its equipment. In doing so it was assisted considerably by the mine operators who divided the power available, part working one shift and part another. The new unit was started within a few days and operated non-condensing, since the condenser equipment was delayed in shipment.

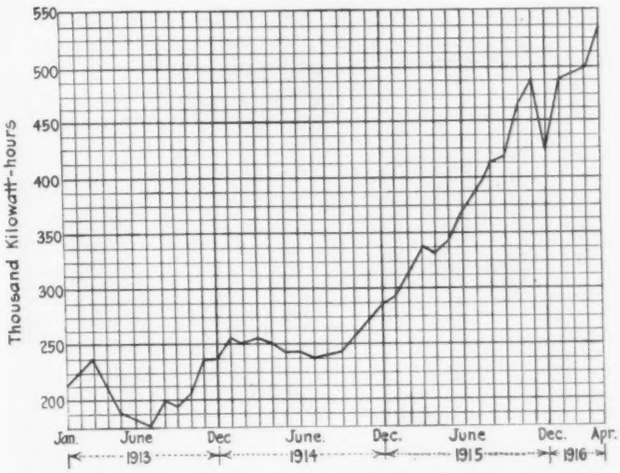


FIG. 2—OUTPUT CURVE OF GALENA (ILL.) STATION, SHOWING BUSINESS INCREASE SINCE WAR

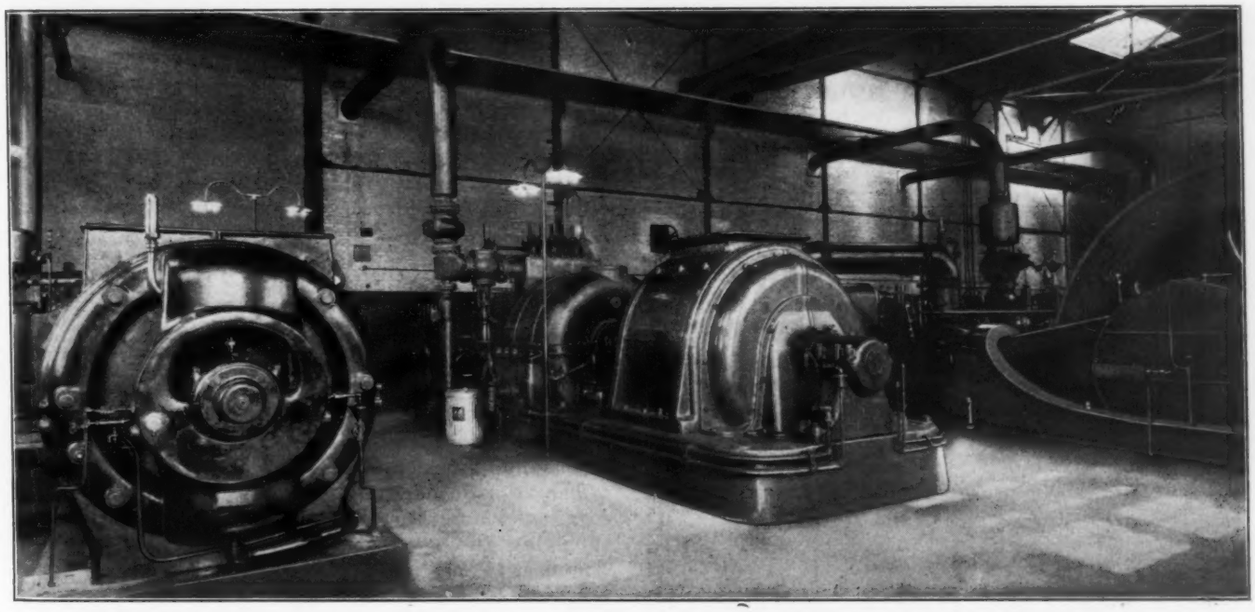


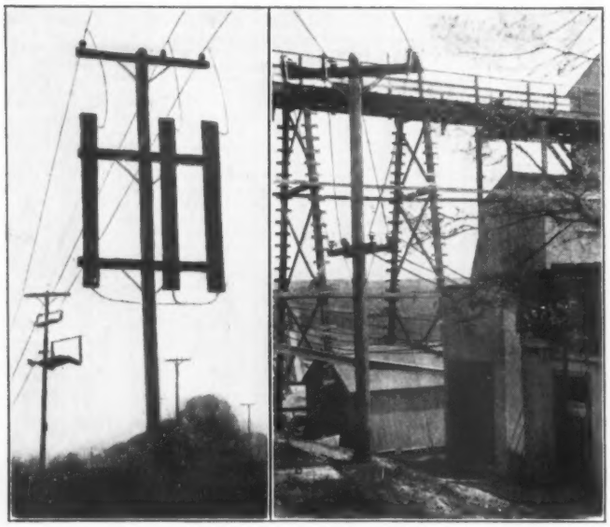
FIG. 1—INTERIOR OF GALENA (ILL.) STATION GENERATING ROOM

Since the first of the year the company has purchased from the Louisville (Ky.) Gas & Electric Company a 4000-kw. Westinghouse unit which will supplement the generating equipment now operating in the Galena plant. The latter includes the new 2500-kw. unit, a 2000-kw. unit, and two Allis-Chalmers cross-compound reciprocating engines of 1500 and 1250-kw. rating. In addition a 3000-kw. synchronous condenser has been purchased for use at the Hazel Green substation to improve the power factor. Two new 410-hp. EdgeMoor boilers with Westinghouse stokers have been installed and the station enlarged to accommodate them. The steaming equipment prior to this addition comprised 2460 hp. in EdgeMoor boilers with chain-grate stokers. Four of these stokers have been replaced with Westinghouse stokers.

Considerable outside-plant developments were also made, including the building of new substations, extension of transmission lines, installing new transformers, and increasing the rating of transformer installations at the older mines. At five of the mines the 350-kw. transformers were exchanged for 375-kw. units, the other mine transformers being large enough, although their period of service was increased. Two portable substations, one of 750-kw. rating and the other of 650-kw. rating, were installed in the New Diggins district and in LaFayette County, Wis., respectively, to serve new mines. Still another work of the company, looking to the assurance of reliable service, has been the construction of an 18-mile, 33,000-volt, wish-bone type transmission line, tying its system in with that of the Union Electric Company, Dubuque, Iowa. This line will permit the exchange of 2000 kw. in power.

Thirty different zinc-mining properties are connected to the lines of the Interstate Light & Power Company, giving a connected load ranging from 200 hp. to 400

hp. These are located both north and south of Galena, but the principal mining center is 18 miles northeast at Benton and New Diggins. The Black Jack mine is located 4 miles south of Galena, and other mines are at Platteville, 30 miles north, Hazel Green and several other places. The general scheme of serving the mines



FIGS. 3 AND 4—MINE TRANSMISSION LINE AND TRANSFORMER HOUSE

On the left are shown lightning arresters mounted on second pole from transformer house at Black Jack mine; the terminus of the 13,000-volt Black Jack mine line is shown on the right with choke coils mounted on first pole from transformer house.

is from two 33,000-volt transmission lines connecting various substations, from which 4000-volt lines are run to the mines. There the voltage is stepped down to 220 volts for distribution throughout the mines, energy being purchased on the 220-volt side of the transformers.

Under present market conditions the mines are operating two ten-hour shifts a day with four hours' intermission for repairs and special work. Some of these mines, especially those near Benton, have a heavy con-

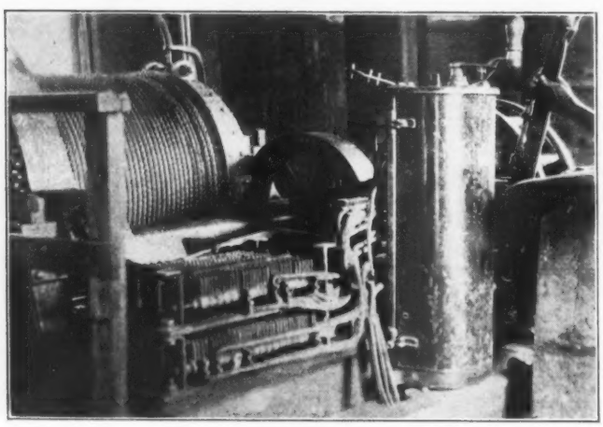


FIG. 5—MOTOR-DRIVEN BUCKET HOIST

tinuous twenty-four hour pumping load, centrifugal pumps having generally displaced the former lift pumps. The other equipment common to all the mines is as follows:

50 or 75-hp. pump motor, with duplicate spare outfit for emergency.
75-hp. motor on an air compressor.
75 or 100-hp. motor in the mill driving the jigs, rolls, crushers and elevators.
50 or 75-hp. motor on bucket hoist.
22 or 37-hp. motor on cage hoist.
5-hp. motors or higher on ventilator fan, small pumps, etc.

The output of zinc blende, in the Galena and Joplin (Mo.) districts, is increasing steadily with a corresponding growth of the load on the central station. As the Interstate Light & Power Company does not anticipate that there will be any particular slump in the rate of production for some time to come, it is providing all the generating equipment that the demand calls for. The load factor for the individual mines runs about 62 or 63 per cent.

Artificial-Ice Skating Rink as Long-Hour Load

As a result of the rapid increase in popularity of ice skating in San Francisco a large ice rink, known as the Winter Garden, was recently opened in that city, utilizing a building which formerly served as a roller-skating rink. All of the equipment installed is electrically operated, the total motor capacity being 216.5 hp., in addition to which there is a lighting load of about 35 kw. Thus far the intention is to operate the rink during the entire year instead of through a "skating season" only, as is usually the case in ice rinks.

The ice area is 90 x 204 ft. and this is served by a brine refrigerating system whose rated capacity is 120 tons of ice per twenty-four hours. About 2500 gal. of brine are used and this is normally circulated at the rate of 15 gal. per minute. There are two ammonia compressors made by the Cyclops Machine Company, one of which is driven by a 75-hp. motor and the other by a 100-hp. motor. (These two motors being the only ones available near the desired size when the rush construction of the rink was undertaken.) In addition to these main units there is a 15-hp. motor driving a 15-in. brine pump and a 10-hp. motor driving a 5-in. brine pump. Two 5-hp. motors give circulation in the cooling system and a 3-hp. motor is used in the brine tank circulation. There are also two motors of 1 and 1.5-hp. capacity in the blower system which provide heated air for the ice arena and a 1-hp. skate grinding motor.

The motors driving the two ammonia compressors, and which constitute the main part of the load, are operated on a schedule governed by the "skating sessions" which are from 10 to 12 a. m., 2 to 4 p. m. and 8 to 10 p. m. This affords, comparatively, a very desirable load, the operation being as follows:

Hours of Operation	Horsepower Used
8 a. m. until 10 a. m.	85
10 a. m. until 12 m.	170
12 m. until 2 p. m.	85
2 p. m. until 4 p. m.	170
4 p. m. until 8 p. m.	85
8 p. m. until 10 p. m.	170
10 p. m. until 4 a. m.	85

Or, two motors are in use six hours and one motor twenty hours, which afford a load factor of 54 per cent.

The transformer room contains three 100-kw. transformers, which step down from 11,000 to 440 volts for supplying the two compressor motors. The lighting system is taken care of by a 100-kw. transformer wound for 6600 to 110 volts. All of these transformers, as in the case with the large motors, were used because they were the most nearly suitable equipment among that which was available on short notice.

An interesting feature noted in operating this plant is that it is desirable not to keep the ice temperature so low that the ice will be very hard during the sessions when the greatest number are using it. With 1500 skaters on the ice at one time, it has been found that if the ice is kept too hard the friction of the skates will cut it away and expose the pipes in less than the duration of one skating session.

Between sessions the ice is scraped, sprinkled and refrozen, an electric storage battery truck being used to drag the scraper.

An Experiment in Househeating by Electricity

For Seven-Room Seattle Dwelling, Electric Heating at 1 Cent per Kilowatt-Hour Cost Three Times as Much as Heating by Coal—With Half-Cent Energy, However, Advantages of Electric Heat May Justify Added Expense

BY FREDERICK A. OSBORN
Professor of Physics, University of Washington, Seattle

THE possibility of having our homes heated by electricity has for some years been claiming more and more attention. The many advantages of electric heating, the quickness and ease of the temperature control, its freedom from dirt in the rooms and in the basement, the ability to place the heater where it is most needed—all these advantages and others have aroused the interest of many and raised hopes that in the Pacific Northwest, with its abundant water sources, electric heating was not far distant.

It seemed desirable, therefore, to make a careful comparison of the cost of heating an average-sized house by coal and by electricity. The dwelling used in the experiments was the author's own residence. That the comparison of cost might be fair, it was decided to make the number of rooms heated by each system the same, and as far as possible to maintain during each test the same average room temperatures. The details of the experiment follow.

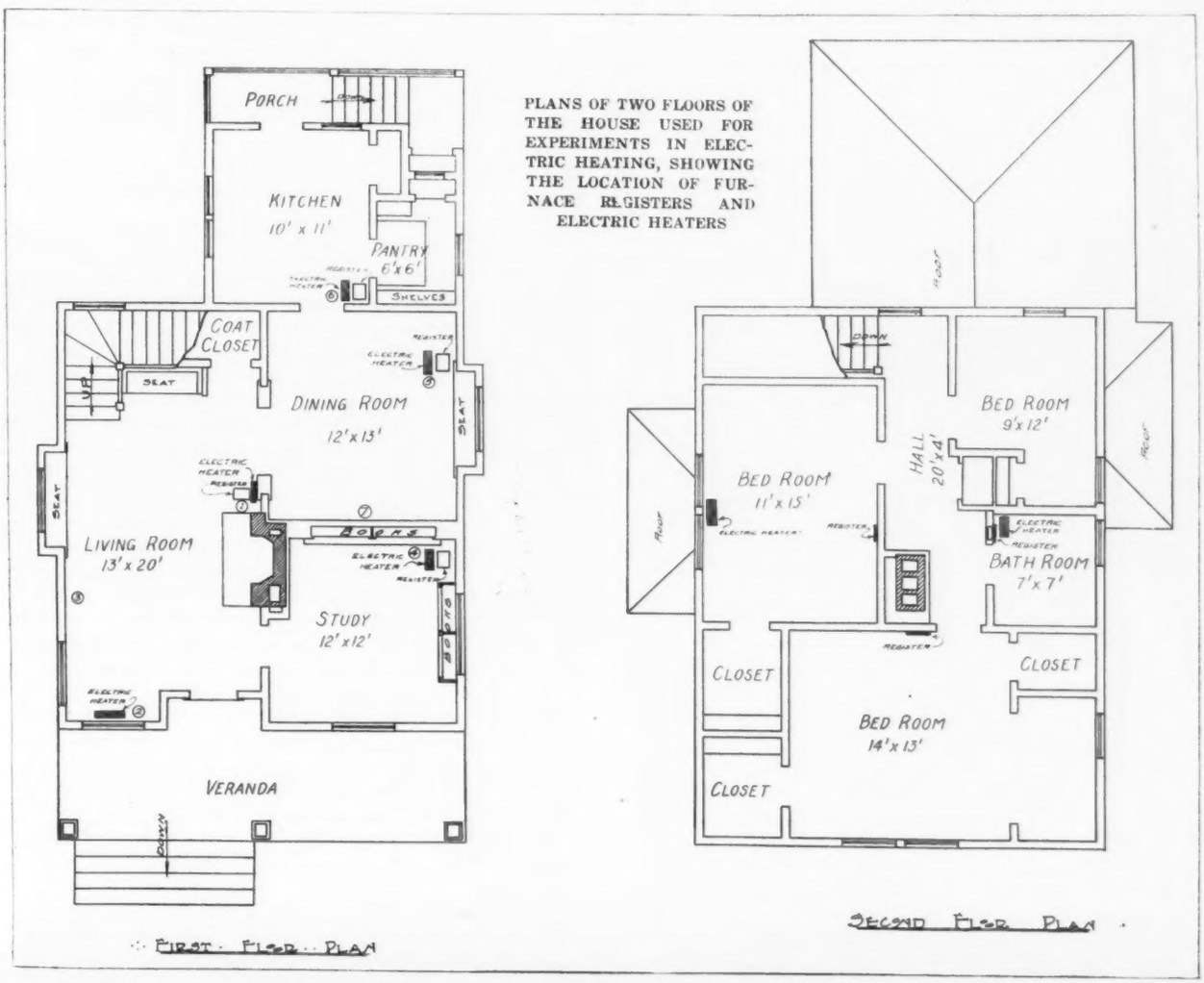
The floor plans of the two floors of the house are reproduced herewith and the locations of the furnace registers and the electric heaters are indicated.

The house is ordinarily heated by an 024 Standard hot-air furnace. For the past three years a high grade of lump coal has been used, costing for the present year $7.75 per ton in the basement bin. The average cost of heating the house, including the wood used in the fireplace, has been about $75 a year for the last three years.

All the rooms heated were equipped with the wire-resistance convector type of electric heater. There were five American heaters and two Hot Point heaters. In the dining room a hot-water radiator, to which was attached an induction-type electric heater, was used during a part of the time.

The living room, with a volume of 2400 cu. ft., had two 3000-watt heaters, with three heat controls. The heaters were at positions 1 and 2 as shown in the sketch. The maximum wattage was 2.5 watts per cubic foot.

The study, a room of 1300 cu. ft., had one 600-watt heater at position 4. The power taken per cubic foot was 0.46 watt. The temperature of the study seldom was above 64 deg., and this was by choice.



PLANS OF TWO FLOORS OF THE HOUSE USED FOR EXPERIMENTS IN ELECTRIC HEATING, SHOWING THE LOCATION OF FURNACE REGISTERS AND ELECTRIC HEATERS

The dining room has a volume of 1410 cu. ft. It was supplied with one 2000-watt heater, and for a part of the time a 2500-watt water radiator was used. The maximum demand was 1.4 watts per cubic foot.

The kitchen and pantry, with a volume of 500 cu. ft., had a 1000-watt heater. This heater was for most of the time on the low heat, taking about 300 watts, the gas range when the oven was in use furnishing the necessary heat.

The south bedroom, volume 1320 cu. ft., had one 2000-watt heater. This room is used also as a sewing room, and is warmed nearly every afternoon.

The bathroom on the north, with a volume of 350 cu. ft., was supplied with one 1000-watt heater, kept on the low heat most of the time.

As the entire test was carried out with one type of heater, the question will naturally rise, may not some other type of electric heater be more efficient than the type used? Electric heating differs from all other systems of heating in that all electric heaters of the same wattage are equally efficient. They will all deliver the same number of heat units to the room. In furnace heating the amount of heat escaping up the chimney depends upon the furnace, the method of firing it and other factors not constant. The heat given to the room is that which is not lost in the furnace, the flues and the transmitting pipes from furnace to the room. Coal furnaces deliver from 40 per cent to 60 per cent of the heat in the coal to the rooms.

Electric heaters, on the other hand, deliver practically 100 per cent of the heat to the rooms. For each kilowatt-hour of electrical energy put into any type of electric heater, the same amount of heat is furnished. There may be some minor advantages in using one type of electric heater in preference to another type, but this advantage never consists in getting more or less heat units from a kilowatt-hour of electrical energy. This fact needs to be kept constantly in mind when discussing the advantages of electric heaters.

Throughout the entire test a recording thermometer giving continuous readings of the temperature was kept in the same position in the living room. The thermometer was on the piano at position 3, as shown in the sketch. In the dining room a second recording thermometer was placed on the plate rail at position 7.

TABLE I—TEST WITH HOT-AIR FURNACE

Week of	Average Outside Temperature, Deg. F.	Average Living Room Temperature		Coal Consumption, Lb.
		8 a.m. to 10 p.m., Deg.	10 p.m. to 8 a.m., Deg.	
December 1- 8	49.2	67.7	62.8	631
December 8-15	43.5	65.7	60.0	667
December 15-22	44.0	65.8	61.1	560
December 22-29	39.5	65.8	61.0	660
December 29-January 5	29.4	66.0	59.0	780
January 5-12	33.0	65.0	58.0	755
January 12-19	29.0	67.0	58.0	837

The outside temperature was taken from the recording thermometers at the university after a recording thermometer at the house gave evidence that the outside temperature at the house and the university did not differ by more than a degree.

The dining room thermometer as well as the one in the study were used in each part of the test to determine the similar heating conditions under the two systems, and when this was established they were read only occasionally.

This test was begun Dec. 1 and continued until Jan. 19. During this period Seattle had the coldest weather of the season. The coal used was carefully weighed, part of the time daily, and later the coal for two or three days' burning was weighed at one time. In Table I is found the record of the test.

The average outside temperature for the seven weeks was 38.2 deg. Fahr., the day room temperature was 66.1 deg. Fahr. and the night room temperature was 59.9 deg. Fahr. During the day the room was maintained at an average temperature of 27.9 deg. Fahr. above the average outside temperature. The total coal consumption was 4890 lb., or an average of 698 lb. per week. The total cost of the coal at $7.75 a ton was $18.95, or an average of $2.42 per week.

This part of the test began on Feb. 1 and continued until March 14. The detailed record appears in Table II.

TABLE II—TEST WITH ELECTRIC HEATING

Week of	Average Outside Temperature, Deg. F.	Average Living Room Temperature		Kilowatt-Hours Used
		8 a.m. to 10 p.m., Deg. F.	10 p.m. to 8 a.m., Deg. F.	
February 1- 8	36.3	67.0	57.5	1039
February 8-15	46.7	67.3	60.0	741
February 15-22	41.9	66.0	58.4	575
February 22-29	40.5	66.5	56.4	573
February 29-March 7	36.0	64.6	56.0	794
March 7-14	47.6	66.5	57.6	522

The average outside temperature for the six weeks was 41.5 deg. Fahr., the day room temperature 66.2 deg. Fahr., the night room temperature 57.6 deg. Fahr. The living room was maintained at an average temperature of 24.7 deg. Fahr. above the outside temperature. The total number of kilowatt-hours used was 4274, or an average of 712.3 per week. The cost for the six weeks at 1 cent a kilowatt-hour was $42.74, or an average cost of $7.12 per week. To this cost should be added $2.50 for heating by gas the water used for domestic purposes. The furnace having a water coil in it furnished the hot water in the first test.

If we assume that the loss of heat from a room is proportional to the difference in temperature between the outside and the inside, then the furnace furnished to the rooms $\frac{279}{247} = 1.12$, or 12 per cent more heat, and the consumption of electrical energy for the same amount of heat would have been 4787 kw.-hr. Taking into consideration then the cost for water heating and for furnishing the same amount of heat, the cost for electric heating under the same conditions as obtained during the furnace heating would have been $50.37, or $8.39 per week. This makes electric heating cost 3.46 times that for coal under like conditions.

From this test, electricity selling at 0.29 cent per kilowatt-hour would furnish heat for the same cost as coal at $7.75 a ton. To many the advantages of electric heating are worth a 50 per cent increase in the cost of heating, and electricity at about one-half a cent per kilowatt-hour would make this possible.

A lower rate is usually given by electric companies for "off-peak" loads. In the winter the peak load comes on about 4 o'clock in the afternoon and lasts for four or five hours. If the customer using electricity for heating is to receive this low off-peak rate, some means must be provided for storing up a surplus amount of heat to be drawn on during the time the current is cut off from the heating system. Storage tanks using water are in use, but as far as the writer is informed no entirely satisfactory storage system has as yet appeared. The "off-peak" service compels the use of liquid-filled radiators, and makes electric heating no more flexible than the hot-water or steam systems.

Electric heating at the present must, therefore, unfortunately he numbered with the things "hoped for."

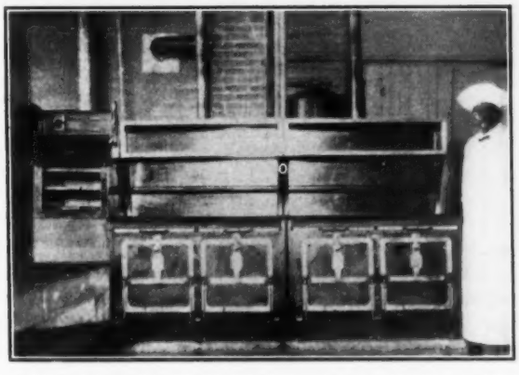
COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Texas Power Company Plans to Install 2000 Ranges Next Year

A modern hotel-type electric range has just been installed in the dormitory of Baylor College, a girls' school at Belton, Tex., for preparing the meals for the 500 girls who board at the college.

The installation consists of two large ranges, each having a connected load of 15.5 kw. Each oven has one upper unit of 1000-watt capacity and one upper unit of 2000-watt capacity, there being two ovens to each range. Each range has four 1600-watt front hot plates and four 800-watt rear hot plates. In addition to the ranges there is also installed one 5-kw. broiler, which is operated separately from the ranges. This broiler will cook 75 lb. of steak 1 in. to 1.25 in. thick each hour. There is also installed a 6-kw. bake oven and a 6-kw. water heater. The total connected load on the entire cooking and water heating installation is 48 kw. Approximately 165 kw.-hr. of electricity is used per day, about 50 kw.-hr. of this being taken by the water heater. Energy is being furnished by the Texas Power & Light Company.



A 31-KW. ELECTRIC RANGE INSTALLATION WHICH COOKS FOR 500 GIRLS AT BAYLOR COLLEGE, BELTON, TEX.

This company has, during the past year, placed over 500 electric ranges in Texas homes and has set a "bogey" for 1917 of 2000 ranges. This record is even more interesting when it is considered that every one of these ranges is in a separate home, there being very few apartment houses in the company's territory. This is an average of one range to every 640 people in the territory. At the end of 1917 the company expects to have an average of one range to every 125 people in its territory.

Designing House Walls and Floors for Electric Heating

In order to render the electric heating of its operator's cottage at Powerdale, Cal., economical, the Pacific Power & Light Company made a special effort to construct the walls and flooring of the building so as to minimize the loss of heat by conduction or radiation. The floors are made up of 1-in. Oregon fir laid over 1-in. shiplap. The sidewalls are made of 1 in. sheathing, with a shingled exterior laid over building paper.

Lighting of Department Store to Facilitate Color Matching of Fabrics

After trying out several types of lighting fixtures McCreery's department store in New York City has installed on the first four floors fixtures which give a quality of illumination approximating daylight, thus facilitating the matching and comparison of fabrics.

The bowl units, each containing a 500-watt gas-filled lamp, are hung 10 ft. from the floor on the first floor, where the ceiling is 20 ft. high. On the other floors the fixtures are suspended 9 ft. from the floor, and each unit lights a bay of approximately 20 sq. ft. The bowls used are of a form of glass known as "Celestialite," being made up of three layers of different kinds of glass, dipped successively and blown at one time to insure an even distribution of each layer. The layer nearest the source of light is a blue glass, the function of which is to filter out part of the red rays. Next to the blue is a layer of white glass which diffuses the light and renders the entire bowl luminous. Plain glass forms the outside layer, and is used to give body to the globe. The bowls are the product of the Gleason-Tiebout Glass Company of New York, and the

THE BOWL OF THE FIXTURE IS DESIGNED TO PREVENT CEILING SHADOWS

WHEN THE NEW LIGHTS WERE INSTALLED IN THE SILK DEPARTMENT, ACCURATE COLOR MATCHING WAS MADE POSSIBLE

fixtures were made up and installed by J. Livingston & Company, also of New York.

The bowls are suspended from four chains and are 19 in. across at the point of suspension, widening to a maximum diameter of 22 in. The greatest depth is 12 in.

Each fixture is equipped with a 500-watt type C lamp, the socket for which is a part of the combination reflector and cover. This closing reflector, although light tight and dust-proof, is adequately ventilated. The reflecting function has been carefully designed in order to throw a maximum of light through the bowl.

Four chains placed 90 deg. apart support the reflector, and when a lamp is changed two opposite chains are disconnected, and the whole reflector is swung about the other two as an axis, giving free access to the lamp, and making it possible for one man to do the work conveniently.

According to officials of the McCreery company, the present lighting system is giving entire satisfaction. Employees find the light "easy" on their eyes and colored material is matched under its rays without difficulty, all shades of pinks and blues being easily distinguished from one another. This saves time formerly used in going to windows to match colors, and also cuts down the loss from returned goods. The arc lamps which the new fixtures replace were rated at 720 watts each, and a material saving has resulted from the use of the incandescent units, not only in energy consumption, but also in maintenance.

How a Central Station Disposed of Cooperage Plant Waste and Secured Service Contract

Before reaching the decision to adopt electric drive, the Western Cooperage Company of St. Johns, Ore., proposed to the Portland (Ore.) Railway Light & Power Company that if a market could be secured for the major portion of its wood waste, an agreement would be entered into for the purchase of electric service. Otherwise, in order to consume at least a part of the enormous amount of waste fuel that is a by-product of the work in hand, the plant would be forced to generate its own energy. This problem is a particularly important one in the case of a cooperage plant, because the waste amounts to so much more than it does in ordinary sawmill practice, only about 35 per cent by weight of the original log appearing in the finished product.

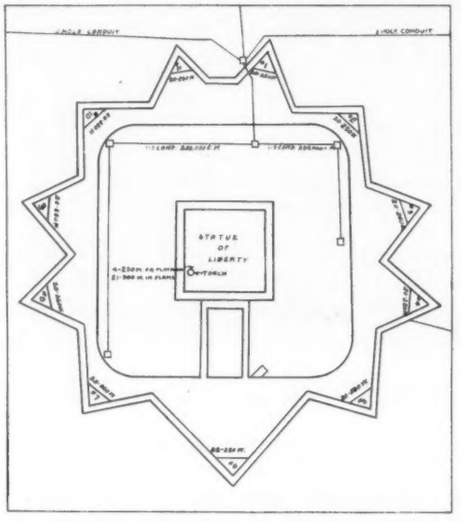
After an investigation of local conditions, the power company accepted the proposition made by the plant management and three separate and distinct consumers of the waste were found as follows: (1) For certain portions of the waste product resulting from sawing hemlock and spruce logs a market was developed in local paper mills. Small pieces of wood were put through a machine known as a chipper, and these chips were found to run substantially the same in quality as those produced by the paper mill itself from the original log. This particular outfit provides for 35 per cent of the so-called waste. The market is a steady one, and the cooperage company is assured of this outlet for a considerable length of time. (2) Pieces of slabs, bark, edgings, trimmings, etc., of a size which can be handled by the local wood fuel dealers, were sold under contract to one of these fuel companies. Waste suitable for fuel of this sort is separated and conveyed to bins or hoppers for loading into wagons by gravity. (3) All of the remaining waste which cannot be sold under one or the other of the foregoing classifications is conveyed to a machine known as the "hog," ground into fine pieces, and then conveyed to storage bins, where it is loaded by gravity into barges and sold to large industrial plants in the vicinity as fuel suitable for use under boilers. This material makes a very good fuel if burned in a properly designed furnace, and commands a ready market where it can be economically handled.

THE ILLUMINATION OF LIBERTY

Two Hundred and Fifty 250-Watt Projectors Light Statue and Pedestal—New Amber-Glass Torch Contains Twenty-one 500-Watt Lamps

BY R. F. CARBUTT AND H. H. MAGDSICK

In designing the lighting installation for the Statue of Liberty the purpose was merely to render the work of Bartholdi visible at night so that the conception which the sculptor had wrought into this monument might be seen and felt by the ever-increasing numbers of people. No effort was made to create a spectacle or brilliant effect, possibilities for which are always at hand with modern electric illumination. The problem, therefore, became largely one of providing the necessary quantity of light for the various parts of the statue and pedestal,



ARRANGEMENT OF PROJECTORS IN ANGLES OF OLD FORT WHICH FORMS BASE OF LIBERTY STATUE

of directing this light efficiently, and of making the installation as unobtrusive as possible.

Any system that might be devised for flood-lighting the statue would, of course, be only an approximation of the ideal, inasmuch as the placing of the sources is limited almost entirely to locations well below the statue and pedestal itself, a condition which might easily result in grotesque lighting effects. To avoid these it was necessary to provide many light sources, distributed among a number of locations and thus give the necessary flexibility by varying the brightness of the different parts to produce the modeling desired.

Two hundred and fifty-two 250-watt lamps were installed in fifteen banks of projectors. Most of these units are in the eleven salients of the fortress wall surrounding the statue and about 260 ft. below its top; four are directed downward from the platform just below the flame of the torch and the others are placed at greater distances on the roofs of three buildings.

The projectors in the salients and at the platform of the torch measure 12 in. in diameter, and are of mirrored glass with copper backing enameled dull black to facilitate radiation and thus make ventilation of the unit unnecessary. Since the units are weather and

dustproof, their maintenance is greatly simplified. The position of the socket is adjustable to permit variation in the spread of the beam.

USE OF 32-VOLT HEADLIGHT LAMPS

The maximum concentration of beam necessary was somewhat greater than is usually demanded. To have obtained this concentration at high efficiency with lamps of the 110-volt type would have required projectors of greater focal length and diameter, hence more expensive and obtrusive. By the use of 32-volt, 250-watt Mazda type C locomotive headlight lamps, however, the desired narrow beam was secured because of the greater concentration of filament in the low-voltage lamp. This necessitated the use of compensators to transform the energy supply, but the increased efficiency of the 32-volt lamp over the 110-volt more than offset the attendant losses.

From the twenty units located at the greater distances on the building roofs, still more concentrated beams were secured by the use of larger mirrored-glass projectors of parabolic contour.

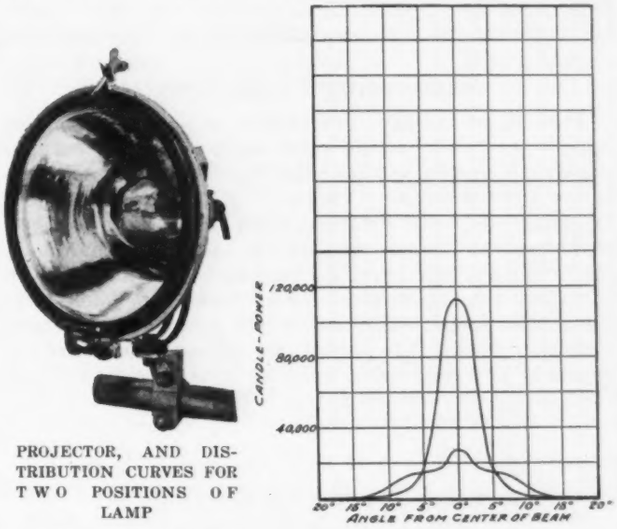
The projectors are equipped with slotted straps through which they are secured to the horizontal members of 1.25-in. galvanized pipe framework by means of clamps. The slotted strap allows adjustment of the units readily in all planes. To the same frameworks are attached the individual compensators one for each projector.

The advantages gained through the use of a large number of units were clearly demonstrated when the units were adjusted. The oxidation of the various surfaces of the statue and the discoloration of the granite in the pedestal have proceeded very unequally. In some parts of the monument this made the proper adjustment of the light difficult, although in many cases the resulting appearance is more satisfactory than by day. In other parts of the figure oxidation has been most marked at the bold lines and heavy folds where high lights are desired.

FLAME EFFECTS IN NEW GLASS TORCH

The flame of the torch was originally executed in metal. Some time after the erection of the statue part of the metal was removed and replaced by a band of glass behind which light sources were placed. The contour was left somewhat angular.

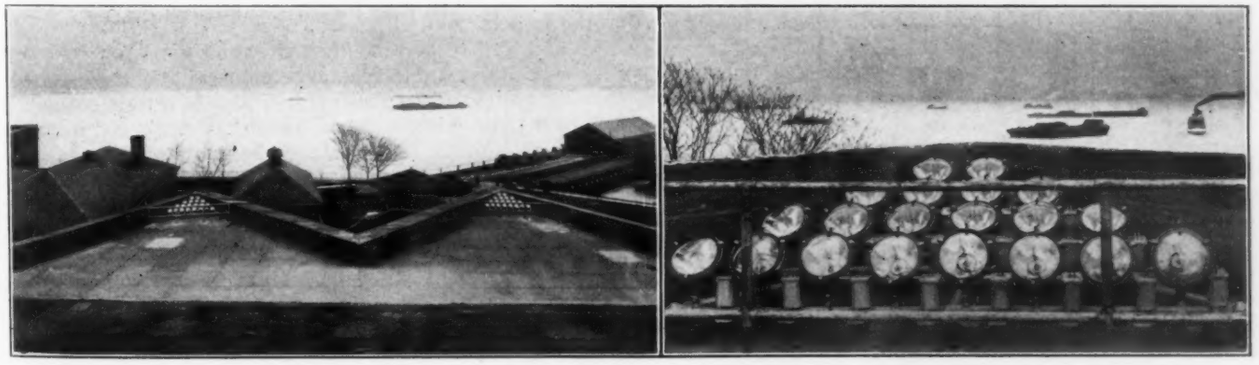
In planning the present new lighting installation it was determined to reconstruct the flame so that every part of it might be luminous. With the co-operation of the American sculptor, Gutzon Borglum, the original contour of the flame was restored. Steel ribs were forged to these lines and were installed to strengthen the structure; sheet bronze completed the surface. The metal surfaces of all parts of the flame were then cut away in small sections, 600 in all, leaving strips of somewhat more than 1 in. in width for attaching glass. Each of the metal sections was replaced with a piece of amber cathedral glass bent to the same contour and secured by spring clips and non-hardening putty, rendering the work waterproof and at the same time resilient to wind stresses. Several densities of amber glass were employed, distributed according to their position in the flame. This difficult glazing problem was solved by Edgar H. Bostock.



PROJECTOR, AND DISTRIBUTION CURVES FOR TWO POSITIONS OF LAMP

Fifteen 500-watt Mazda type C lamps were installed within the glass structure to render all parts luminous. These burn continually and steadily. In order to obtain a variation in intensity and thus somewhat better simulate a flame source, a flasher controls six 500-watt tubular lamps mounted in a fifth-order fixed lighthouse lens, producing an irregular cycle repeated every twenty seconds. Viewed from the harbor, the light from the lens superimposed upon that issuing steadily from the fifteen 500-watt lamps produces a variation of four or five to one.

Of the total light generated by the lamps employed in the projectors, it is estimated that about 30 per cent reaches the surfaces of the pedestal and statue. The resulting average intensity of illumination is more than 10 foot-candles, but the distribution varies greatly with the requirements of the various parts. The average coefficient of reflection for the entire monument is of the order of 20 to 25 per cent, so that the statue and pedestal become a light source of about 6000 cp. The light issuing from the torch ranges from 4000 to 5000 cp. At the highest intensity this is increased by the light from the lens to about 20,000 cp.



LOCATION OF PROJECTORS IN ANGLES OF RAMPART AND ON ROOFS OF NEARBY BUILDINGS—AT RIGHT, ONE OF THE PROJECTOR GROUPS SHOWING FRAMEWORK MOUNTED ON CASTERS, AND INDIVIDUAL COMPENSATORS FOR 32-VOLT 250-WATT LAMPS

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Repolishing Meter Jewels

That it is entirely practicable and good policy to have worn meter jewels repolished—sapphires in particular—is shown by the experience of A. S. Albright of the Detroit Edison Company. Almost identical performance has been obtained from new and repolished sapphires, and since repolishing costs less than half the price of a new jewel the economy is obvious. Pivot holes are not objectionable in all cases, but when serious a microscopic examination will show whether there is enough stock left to permit repolishing. Pivots are replaced by new ones when worn, as it has not been found good policy to repolish them.

Locating Accidental Grounds on Secondary Systems

BY KARL H. BAUSMAN

When accidental grounds occur on its secondary system the Dayton (Ohio) Power & Light Company locates them by means of a telephone receiver and an exploring coil. Photographs of the equipment and a line drawing of the variable reactance are reproduced herewith. To use this apparatus most effectively a variable reactance is found advisable in the circuit leading from the secondary neutral to ground, thus amplifying the sound produced in the receiver when the exploring coil is brought near the grounded wire. After this preliminary preparation has been made the investigator stands

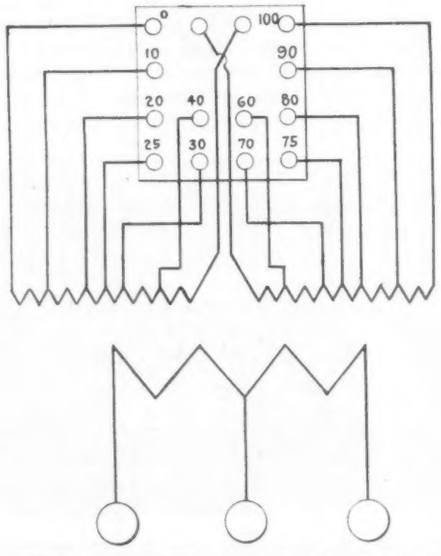


FIG. 1—INTERNAL CONNECTIONS OF VARIABLE REACTANCE USED TO AMPLIFY GROUND-DETECTOR SENSITIVITY

under the secondary wires with the exploring coil parallel to them and listens for a distinct hum in the receiver. When this is detected the operator walks along under the secondary wires until the hum ceases. At this point the exploring coil is held parallel to the nearest service wires to ascertain under which the hum is resumed. When this has been determined the circuit can be followed with the exploring coil until the hum again ceases, which indicates that the ground may be found near by.

The hum produced in the receiver by an accidental ground is distinctly different from any sound caused by current flowing to lamps or other appliances and can be followed regardless of whether the transformer is supplying energy or not. Furthermore, it may be pointed out that a trained ear can detect a ground current of only a few amperes when the exploring coil is held as far as 40 ft. from the conductor. Thus the apparatus is sensitive enough for detecting grounds on most lines strung overhead.

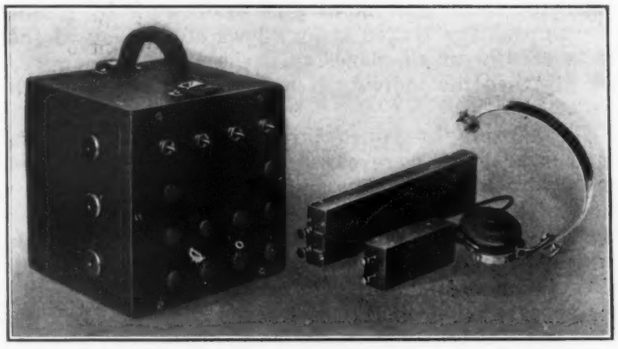


FIG. 2—VARIABLE-REACTANCE BOX, TWO SIZES OF EXPLORING COILS AND RECEIVER

Two exploring coils are provided with the outfit. Each consists of a fiber shuttle with a laminated iron core. One of the coils has a core length of 2.5 in. and consists of 4000 turns of No. 40 silk-covered wire. The other coil is longer and consists of 2000 turns of No. 33 cotton-covered wire. The small coil is used for detecting very severe grounds and the longer coil when greater sensitivity is necessary. Both sizes are illustrated in Fig. 2.

In addition to amplifying the sound given off by the receiver, the variable reactance changes the wave form thereby giving to the receiver vibrations, a tone entirely different than that produced by energy delivered to any motors or lamps. The reactance has an iron core taken from a General Electric Form D-20 current transformer, the laminations of which are circular and have a cross-sectional area of 2 sq. in. The primary windings consist of 400 turns of No. 15 single cotton-covered wire arranged in two sections of 200 turns each. Taps are connected with the fortieth, eightieth, 100th, 120th and 160th turns of each section. Two turns of No. 10 wire with a mid-tap are used for the secondary winding. This is employed only for testing meters, giving a phantom load. The receiver used with this outfit is a 1000-ohm instrument equipped with a head clamp.

It may be pointed out that older methods of locating faults are usually tedious, and a great many times require the cutting of wires at numerous places. This is expensive when large conductors or conduit wiring are involved. The apparatus just described was designed by the writer.

EMERGENCY DRIVES DURING PERIODS OF HIGH WATER

How Arrangements Have Been Made to Operate One Water-Wheel Generator by a Steam Engine and Another Generator by All Water Wheels When Hydraulic Head Is Reduced

Arrangements have been made at the Canaan hydroelectric plant of the Connecticut Power Company so the two generators which are installed may be operated at full load even when the head is considerably reduced during high water. Ordinarily, each generator is driven through bevel gears by three vertical water-wheels designed for a 12-ft. head. During flood seasons, however, the tail-race water sometimes rises so high that the water-wheels will not develop their rated power. Accordingly provisions have been made so that one generator can be belt-driven by a steam engine while the other is run by all of the water-wheels. To permit this method of operation couplings that may be easily disconnected have been inserted between the water-wheels and their respective generators and a cross belt provided to connect both sets of water-wheels together. An idler pulley is installed below the lower side of the cross belt to increase the arc of contact on the driving and driven pulleys. So that the two sets of water-wheels will not have to be connected all of the time clutches are inserted between their shafts and the respective cross-belt pulleys. In addition to these connections, on each side of the coupling in one generator shaft, pinions have been fastened so they may be connected by silent chain drive with a counter shaft which permits operating the water-wheels at the reduced speed of 275 r.p.m. and the generator at 400 r.p.m., or its normal speed. This back gear arrangement was necessary since it was sometimes impossible without it to operate the generator at normal speed, and consequently normal voltage.

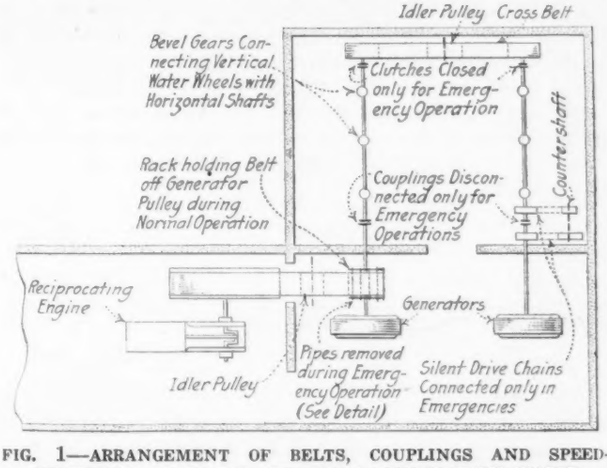

Idler Pulley
Cross Belt
Bevel Gears Connecting Vertical Water Wheels with Horizontal Shafts
Clutches Closed only for Emergency Operation
Countershaft
Rack holding Belt off Generator Pulley during Normal Operation
Couplings Disconnected only for Emergency Operations
Reciprocating Engine
Generators
Pipes removed during Emergency Operation (See Detail)
Silent Drive Chains Connected only in Emergencies
Idler Pulley

FIG. 1—ARRANGEMENT OF BELTS, COUPLINGS AND SPEED-REDUCTION GEARS FOR OPERATION DURING HIGH WATER

For driving the other generator during high water a 250-hp., non-condensing four-valve engine is employed. A non-condensing reciprocating engine was used as steam economy was secondary and fixed charges on investment had to be kept as low as possible since the unit is operated only in emergencies. To minimize the cost of the building to house it, the engine was set as close as possible to the generator it drives and the necessary arc of contact on the driven pulley obtained by means of an idler pulley. So that relatively little time will be required to start up the emergency drive aside from firing the boilers, the belt is always left on the steam-engine flywheel and held away from the generator pulley by a special support which is shown in Fig. 2. The support consists of two strap-iron rings, a little larger than the generator pulley, which are supported from the floor and held at the proper distance apart by a steel framework. Around the periphery of each ring in corresponding positions are semi-circular slots in which short lengths of pipe can be laid to hold the belt away from the pulley. With this arrangement all that is necessary when the generator must be converted from water to steam drive is to disconnect the water-wheel shaft coupling previously mentioned, remove the pipes from the belt support, and adjust the idler pulley to give the proper belt tension. It may be pointed out

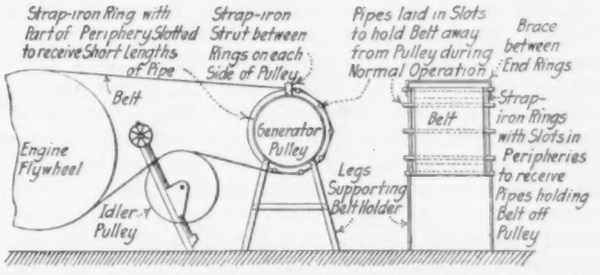

Strap-iron Ring with Part of Periphery Slotted to receive Short Lengths of Pipe
Strap-iron Strut between Rings on each Side of Pulley
Pipes laid in Slots to hold Belt away from Pulley during Normal Operation
Brace between End Rings
Belt
Belt
Strap-iron Rings with Slots in Peripheries to receive Pipes holding Belt off Pulley
Generator Pulley
Engine Flywheel
Legs Supporting Belt Holder
Idler Pulley

FIG. 2—METHOD OF HOLDING STEAM-ENGINE BELT OVER WATER-WHEEL GENERATOR PULLEY DURING NORMAL OPERATION

that for this purpose as well as to allow slack when the belt is held away from the generator pulley, the idler-pulley base is supported on inclined slides and can be adjusted in position by a hand wheel which raises or lowers the pulley base by means of worm screws.

Disadvantages of Crystalline Materials to Improve Heat Dissipation of Cement Protecting Cable Sheaths

While cement is used quite extensively as a protective coating for underground cables, it does not always accomplish its purpose entirely satisfactorily. It is better than asbestos in that it is less liable to start electrolytic corrosion of the lead, assisted by salts of the earth in absorption or not; it has more favorable mechanical characteristics and longer life; is better able to withstand the severe mechanical stresses and high temperatures of a powerful arc. Cement does not, however, possess the heat-resisting and dissipating qualities to the extent that is desirable, and several attempts have been made to improve it in this regard.

Most of these attempts have been in the direction of increasing the water content in the cement by the addition of substances which would permit advantage to be taken of their heat of dissociation to dissipate the intense heat generated by an arc. The two substances most readily suggesting themselves for this purpose are sodium carbonate or sal soda and borax, for both possess a very high water content, the former about 63 and the latter 48 per cent.

Not the least function of the cement coating is to protect the sheath against mechanical injury and to assist in supporting the cables in the absence of shelves or racks. The addition of water-bearing crystalline materials such as sodium carbonate and borax, the latter more particularly, have such a deleterious effect in reducing the tensile strength of the cement as to defeat their purpose to a useful extent. In the case of the soda it leaches out from the cement in damp locations, and thus serves no useful purpose. At present the most satisfactory way to protect the lead sheaths is to continue using cement and sand in the proportion of one to three. Its heat-resisting properties and dissipating abilities are not to be despised; its mechanical characteristics are good and its cost low.

VIEWS OF OHIO OPERATORS ON DISTRIBUTION WORK

Protection of Tie-Line Switches by Compression Arresters—Three-Phase Transformers Growing in Favor—Economical Methods of Handling Service Connections

At a recent meeting of the transmission and distribution committee of the Ohio Electric Light Association, ideas of practical value were brought out in a round-table discussion.

R. R. Krammes, Ohio Light & Power Company, Newark, Ohio, expressed the opinion that oil switches should be installed more frequently on customers' transformer installations. While the argument that oil switches for outdoor service are expensive may be advanced, he maintained that they are inexpensive in comparison with the transformers they are used to protect. An installation was cited where $200 worth of switches were used to protect $3,600 worth of 2300/440-volt transformers, as a typical instance of this practice. The need for a switch to sell at $60 to $75 was brought out.

W. H. Hough, Cleveland (Ohio) Electric Illuminating Company, stated that trouble from burnouts experienced with about 200 oil switches in 2300-volt tie lines which are normally operated open has now been entirely remedied by installing compression-type lightning arresters on both sides of the switches.

The discussion on transformers brought out the fact that three-phase units are growing in favor. One engineer stated that for all power customers requiring 10 kw. or more, his company is installing three-phase transformers connected star-delta. The reasons for this preference were that three-phase transformers have proved so reliable in operation that it is now unnecessary to install three single-phase units on the theory that two of them can be used in open delta in emergencies. Furthermore, open-delta operation has been found to create such poor operating conditions as regards regulation and power factor that it is undesirable under any but extreme circumstances. Moreover, a three-phase transformer is less expensive than three single-phase units.

Opinion regarding the proper position for a small transformer on a pole was divided. No one favored placing it on the primary arm; about one-half of the speakers favored placing it on the secondary arm, and the other half thought it should go still lower on the pole. Those who favored the secondary arm as a mounting position objected to a lower position on the ground that this means bringing primary and secondary leads in close proximity, and maintained that the primary lines should be kept at the top of the pole where a lineman expects primary lines to be. Those who took the other viewpoint contended that practically all trouble occurs in wet weather and that consequently transformers and cut-out plugs should be in places that can be safely reached under the worst weather conditions.

In discussing methods of handling customers' service connections, M. H. Wagner, Dayton (Ohio) Power & Light Company, said that by dividing the work so that the line crew does only line work and a service crew does only service installation work, including meter setting, the company has been able to effect a saving. A service crew which costs the company $20 a day, regularly installs and connects up from twelve to fifteen services a day and has in some instances completed twenty services a day.

W. E. Salber, Northern Ohio Traction & Light Company, Akron, Ohio, reported that he has been able to effect a saving and to speed up construction by loading all wagons for construction crews at night. The foreman of each gang, at the end of the day, gives the storekeeper an order for material. The storekeeper then has this material loaded into the wagon before the foreman returns for work in the morning. Records are kept of all material taken out and all material used on jobs. Once a week each crew is checked up on material to prevent loss. Mr. Salber also makes a practice of holding monthly "question box" meetings with his entire construction force. In this way he gets new ideas regarding the work, particularly from that section of the force known as "floaters."

Lively interest was manifested in the Ohio Public Service Commission's present activities in compiling unit costs on construction. One operator pointed out that while it may cost only $6 to set a pole it costs an additional $1.50 to find out that the unit cost was $6. H. J. Buell, Ohio Light & Power Company, Newark, Ohio, stated that in data he had recently obtained the labor cost on a 600-pole line was $12.68 per pole.

Adjustable Marker for Underground Service

C. A. DALRYMPLE

Many states and cities prohibit the tearing up of newly paved streets for a period of five or more years. When underground service is furnished in such zones it is therefore necessary that the electric service company install all conduits and necessary subsurface work prior to the laying of the new paving. Since some companies consider it advisable to install service pipes as far as the curb line for all buildings, in order to take care of new business, it has been found advisable to mark the service pipe location so that it can be easily found when service is continued into the building.

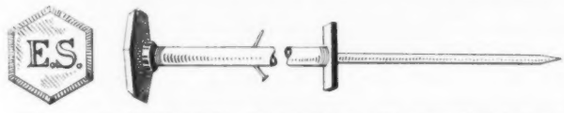


FIG. 1—CONSTRUCTION OF MARKER AND METHOD OF USING

For this purpose an Eastern company makes use of an adjustable Olds marker which can be installed with very little expense, and will probably save considerable time and cost in locating the pipe. As illustrated herewith the marker consists of a piece of iron pipe in which slides a rod which can be adjusted to any length required. On top of the iron pipe is a cast-iron head bearing the name of the company to whom the marker

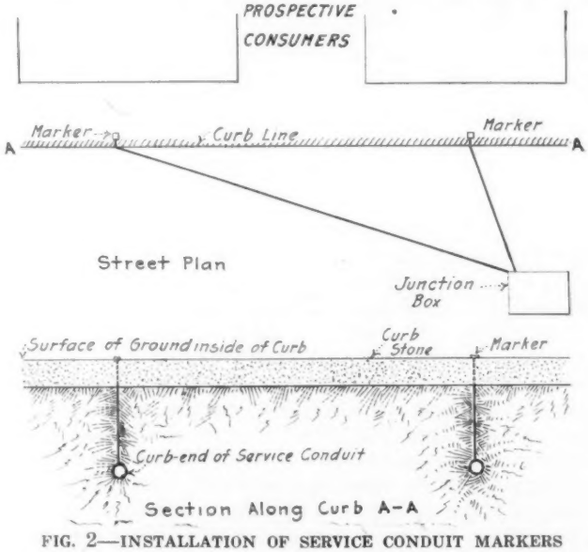


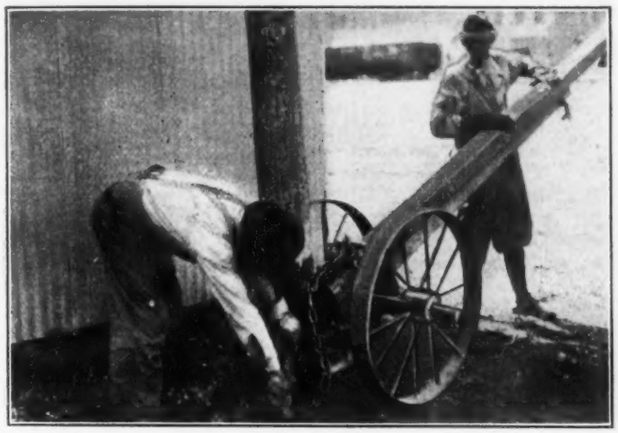
FIG. 2—INSTALLATION OF SERVICE CONDUIT MARKERS

belongs. While the company referred to installs the markers near the curb line, directly over the point where the service pipe ends, it may be found convenient to use them over all service connections.

A Simple Method for Pulling Poles

BY J. H. MOSELEY

A very simple type of pole puller constructed as shown herewith is being used by a Texas company. It consists of two fairly heavy timbers bolted together and supported near one end by two wheels connected with a short axle. To use the apparatus the wheels are run up as close to the pole as possible, the unsupported end of the timber raised in the air and a chain looped



METHOD OF USING HOME-MADE POLE PULLER

around the pole and run over the supported end of the timber and attached securely thereto. Arranged in this way the timber serves as a long-arm lever with the fulcrum near the pole. By bearing down on the free-end of the timber an upward force will be exerted on the pole. After a "lift" has been made on the pole, the lever can be raised and the chain loop slipped down on the pole butt ready for another "hitch."

Motor Equipment of Railroads

In the accompanying table are given the total number and horsepower of direct-current motors and single, two and three-phase alternating-current motors, which, according to the last report of the A.R.E.E., are operated by fifty-six railroads, or about 65 per cent of the total number for the country. The grand total of all motors reported this year amounts to 16,992, repre-

TYPES AND SIZES OF MOTORS USED BY RAILROADS

Type of Motor	Total Number Motors	Total Hp.	Average Hp of Motor
D. C.	8,904	140,892	15.82
1-ph	114	319	2.79
2-ph	1,184	21,199	17.9
3-ph	6,790	134,750.5	19.84
Total (1916)	16,992	297,160.5	
Total (1915)	11,546	183,077	

senting a total of 297,160.5 hp. This is a considerable increase over last year's report, in which 11,546 motors were shown, totaling 183,077 hp. Of the motors reported, those using direct current represent 52.4 per cent in number and 47.4 per cent of total horsepower. Three-phase motors constitute 39.9 per cent of the total number and 45.3 per cent of the total horsepower.

MOTOR OPERATION IN COOPERAGE WORKS

How an Oregon Industrial Company Increased Its Output 25 Per Cent Without Additional Operating Cost by Motor Drive

The Western Cooperage Company recently removed its plant from Aberdeen, Wash., to St. Johns, Ore., and in changing its location decided to design the new plant for electric drive. The new plant was started about Sept. 1, 1915, and its operating record since affords an opportunity to compare the cost of steam and electric drive, because the work now being done is of the same kind and carried on by the same operating organization that had formerly handled the steam-driven machines.

The new plant is located on a bay of the Willamette River near the city of Portland, where there is a natural pond for the logs and where sidings from two railroads extend directly into the plant. The company handles chiefly hemlock and spruce logs, making finished staves and heads which are shipped in bundles to large consumers and to assembling plants located at other points. The capacity of the present works is 125,000 ft., log scale, per ten-hour shift. To handle this material there are installed forty-three Westinghouse motors ranging from 2 to 150 hp., most of which are direct-connected and in some cases are mounted in small groups. All of these motors are of the squirrel-cage type. The total connected horsepower is about 1650, and the energy is supplied at 440 volts, three-phase, 60 cycles. Running at full capacity, the maximum load at the plant is approximately 675 kw., and for a twenty-six-day month, the average consumption for one ten-hour shift per day is 150,000 kw.-hr., the average consumption per 1000 ft. sawed being 50 kw.-hr.

The electric service is controlled from a central switchboard, the wiring for which is so arranged that one circuit feeds each separate department of the mill, and on each of these circuits there are installed kilowatt-hour meters for measuring the energy used, and graphic ammeters of the curve-drawing type, showing the amount of power demand at all times in each department. This enables the mill superintendent to check up each department every day, and in case the consumption is above normal, immediate attention can be given to that department in an effort to locate and reduce the excessive demand.

Since the motor drive has been installed the owners have found it possible to maintain an output 25 per cent in excess of that obtained in the old plant, with practically the same equipment except for the method of drive. This increase in production, it is pointed out, is due to the flexibility of motor drive, that permitted better location of the machinery, and also to the fact that with individual motor drive practically constant speed could be maintained irrespective of the load. This item it is claimed effects a considerable economy in the particular kind of work handled at this plant.

Energy for the operation of the motors at the mill is supplied by the Portland Railway, Light & Power Company, the rate being based on load factor and quantity consumed. For a single ten-hour shift the rate usually works out as the equivalent of about 1 cent per kilowatt-hour, and for two ten-hour shifts about 0.75 cent per kilowatt-hour. On this basis a year's operation of the electrified plant has shown that the net revenue obtained from the sale of the three classes of waste products will amount to more than enough to pay the electric power bills.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

STANDARDIZING SWITCH GEAR

New Proposed Standardization Rules for Marking Switch Gear and Instrument Connections

IN the London *Electrician* of Nov. 24, Dr. Charles C. Garrard discusses the advantages of uniform markings of switch gear and instrument connections and suggests that when the official British standardization rules are revised the following proposals be included:

The busbars on three-phase boards should be colored red, white (or yellow) and blue. Red and blue to be on the outside.

Horizontal busbars or connections: Red phase on top or the bar farthest away as viewed by the operator from the main control position.

Vertical busbars or connections: Red phase to the left or the bar farthest away as viewed by the operator from the main control position.

Connections to busbars: If of bare copper, to be painted same color as the busbars to which they are connected.

Fine wiring or cable directly connected by busbars: These should be colored to correspond with the busbars along their entire length.

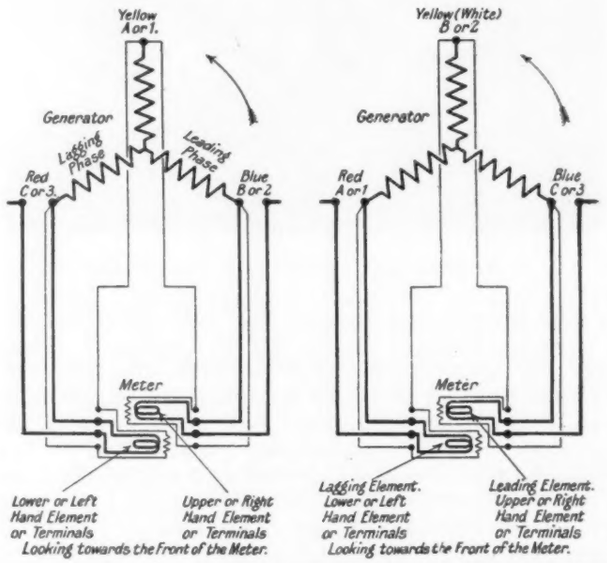
Fine wiring secondary (low tension) connections of current transformers: These must be colored to correspond with the busbars to which they are connected, but as it is possible to reverse one phase by reversing the secondary current transformer connections it is necessary to distinguish between the two. This can be done as follows: The wire connected to the (so-called) low-tension positive terminal (marked t_1) shall be colored the same as the busbars to which the transformer is connected (say, red). The wire connected to the negative (t_0) low-tension terminal shall be colored with two colors (in alternate daubs), *viz.*, the busbar color and white (in this case red and white).

Fine wiring secondary (low tension) connections to potential transformers: The primaries of potential transformers are generally connected across phases; thus the primary connections should be colored the same as the respective busbars to which they are connected.

The low-tension (secondary) connections will also be colored to correspond with the high-tension winding. Thus, if T_1 be connected to the red phase, then t_1 would be colored red, and so on.

The respective busbars must be connected to the machine so that the phase relationship of the current in the busbars bear a definite relation to each other. The obviously correct method is to arrange that the direction of phase rotation should be red-white-blue. That is to say, that the voltage of the red phase should first rise to a maximum, to be followed (1/150th of a second afterward if the periodicity be 50) by the white phase, and then by the blue phase, and so on.

It is very desirable that the terminals of the alternator should also be marked red, white and blue, the phase rotation of the alternator being the same, and then the red terminal could always be connected to the red bar, and so on. As to the markings of terminals of a three-phase alternator the British Electrical and Allied Association has specified that the three terminals should be marked *A, B, C.* The order of phase progression must be in the order *A, B, C.* As to the three-phase wattmeter connections, the author argues these should be made in accordance with the (British) National Physical Laboratory Convention, given on page 18 of E. S. C. Specification No. 37, revised August, 1915 (see Fig. 1). In considering this diagram it must be borne in mind that it is intended to represent the generator winding rotating in respect to the field poles in the direction indicated by the arrow. Thus, the voltage will come to a maximum in the red phase, then in the yellow phase (*i.e.*, after 1/150th of a second if the periodicity be 50), and then in the blue phase, and then again


Yellow A or 1.
Generator
Lagging Phase
Leading Phase
Red C or 3.
Blue B or 2.
Meter
Lower or Left Hand Element or Terminals
Upper or Right Hand Element or Terminals
Looking towards the front of the Meter.
Yellow (White) B or 2
Generator
Red A or 1
Blue C or 3
Meter
Lagging Element. Lower or Left Hand Element or Terminals
Leading Element. Upper or Right Hand Element or Terminals
Looking towards the front of the Meter.

FIGS. 1 AND 2—NATIONAL PHYSICAL LABORATORY METHOD OF MARKING AND TESTING THREE-PHASE METERS, AND SUGGESTED MODIFICATION OF THE LABORATORY'S THREE-PHASE WATTMETER CONNECTIONS

in the red phase. Thus the phase progression is in the order red-white-blue. The blue phase lags 240 deg. after the red phase.

Referring to Fig. 1 it will be seen that the *A* terminal is marked yellow (white), the *B* terminal blue, and the *C* terminal red. The order of phase progression is *A, B, C, i.e.*, yellow-blue-red-yellow-blue-red, which is the same as red-yellow-blue, as suggested above for the busbars. It will be recognized, however, that if the terminals of the alternator are to be colored it is essential that the red terminal of the alternator should be connected to the red busbar, and so on, otherwise confusion will result. If this cannot be done it would be much better not to color the alternator terminals at all, but simply retain the markings, *A, B, C,* and allow the connections to the busbars to be made as may be convenient, only insisting that the phase progression should not be reversed.

For the sake of simplicity, however, there is very much to recommend the arrangement of coloring the alternator terminals so that like colors shall always be connected. If this be agreed it would be very desirable

to slightly alter the N. P. L. Convention, and call the red terminal *A* (or 1), the yellow terminal *B* (or 2), and the blue terminal *C* (or 3) (see Fig. 2).

The author then discusses the effect of an alteration of direction of phase rotation on the accuracy of three-phase meters. If the meter were a perfect one, accurate on all power factors, etc., it would not matter how it was connected up as long as the two current coils were in two phases with the corresponding shunt coils connected from these two phases respectively to the third phase. Meters, however, are not perfect as a rule. If in Fig. 1 the load is non-inductive it is clear that, in spite of this, there will be a difference in phase between the current in the main meter coils and the voltage applied to the corresponding shunt coils. Taking the upper or right-hand meter element the current in its main coil (the load being non-inductive) will lead 30 deg. on the voltage applied to its shunt coil. On the other hand, taking the lower or left-hand meter element the current will lag 30 deg. (the load being non-inductive) on the voltage applied to its shunt-coil terminals. When adjusting the meter care is taken that these phase relationships are adhered to.

It will be clear, however, that if the meter be connected up with the phase-rotation reversed the current in the upper or right-hand element will lag behind its voltage instead of lead, with consequent liability that the constant of the meter will be somewhat different from that to which the meter has been adjusted in the test room. Care must be taken to guard against this by connecting the meter exactly according to the diagram.

Another source of error guarded against by connecting up with correct phase rotation is that due to interaction between the two meter elements. Theoretically both elements should be without effect upon each other. Actually, however, in practice one element will slightly influence the other. In order that the effect may be the same in actual work as on the test bench it is necessary to connect up with the same phase rotation in both cases.

Finally, the author comments on the rule of the British engineering standards committee on additional apparatus connected to transformers. This rule is as follows: "The connection to the secondary windings of transformers, of trip coils, ammeters, and similar apparatus in series with the meter coils is liable to affect the rate of registration of meters and is undesirable. When the practice is unavoidable the meter should be tested, and adjusted with all such apparatus connected in circuit, under the same conditions which will prevail in practice."

The author discusses some objections to this rule, and recommends that it should read as follows: "The connection to the secondary windings of current transformers, of trip coils, ammeters and similar additional apparatus in series with the meter coils is liable to affect the rate of registration of meters, and for this reason the meter should be tested and adjusted with all such apparatus, or its equivalent, in circuit."

Generators, Motors and Transformers

Characteristic Curves of Loaded Synchronous Converters.—C. F. GILBERT.—A mathematical article in which the author gives a simple method for predetermining the characteristic curves of loaded synchronous converters of such large capacity that they can be tested only in the power plant. The method described relates to machines of mean saturation. Curves analogous to those employed for converters of very weak saturation are made use of as well as the diagram of Blondel for synchronous motors. Two principal cases are investigated. First, the constant-potential synchronous converter, and second, the combination of a transformer with a constant-potential converter. Each case is studied for a constant power factor or for a constant excitation of the converter.—*La Lumière Elec.*, Nov. 18, 1916.

Generation, Transmission and Distribution

Parallel Operation of Electric Power Stations.—JOHN S. PECK.—A long abstract of a paper read before the (British) Institution of Electrical Engineers. The conclusions of the author are as follows: Polyphase systems of the same frequency may be connected together directly or through transformers, and operated in parallel without difficulty, but where each station supplies its own customers it is desirable to have some form of voltage regulator to permit independent control of the voltage of each station. If the stations are located in the neighborhood of telephone or telegraph circuits, are connected solidly, and have earthed neutrals, provision must be made to prevent high-frequency currents flowing through earth between the stations. To interconnect a polyphase and a single-phase system of the same frequency a rotating machine of the phase-converter type or a motor-generator is required if the polyphase system is to be symmetrically loaded. Systems of different frequencies may be interconnected through frequency changers, sets consisting of two synchronous machines or of one synchronous and one induction machine. The synchronous set is usually the more desirable, since it permits power-factor control and transmits energy in either direction without a change in the speed ratio between the two systems. It is, however, somewhat more difficult to operate, and to prevent danger from overloading it should have a fairly large capacity with reference to the smaller of the two stations which it interconnects. The induction set is much more flexible, and a small set can be used between two large systems, but it requires a considerable difference in speed ratio between the two systems for transmitting full load, and the induction machine takes wattless current from the system to which it is connected. In certain cases where continuous current is required the rotary converter may be used with advantage as an interconnector between two stations of different frequencies, or between an alternating and a continuous-current system. There is a mathematical appendix on the effect of resistance and reactance on the parallel operation of alternating-current generators and another appendix on the calculation of the load on an induction synchronous frequency changer.—London *Electrician*, Nov. 24, 1916.

Wires, Wiring and Conduits

Effects of a Disturbance on a Three-Phase Network.—H. KEHLS and W. PETERSEN.—An article discussing a peculiar disturbance which took place on the network connected to the main power works, the distributing network consisting of overhead cables with some relatively short lengths of cable. It is connected through a cable 3.2 km. long and through an oil switch to the busbars at the power station in Höchst, from which a considerable length of distributing cables and overhead wires is supplied. On the occasion in question the oil switch opened in consequence of a short-circuit. The switch was immediately closed again and remained closed. Voltmeters are connected between earth and the various busbars, and these showed on phase I 5800 volts, on phase II 6700 volts, and on phase III 6000 volts. Ten minutes later a factory which had a transformer with a capacity of 100 kva., reported that their motors were slowly running in a backward direction; again, twenty minutes later, a similar report was received from another works with two transformers, each

of 250 kva. The reverse direction of rotation of the motors also took place in other works. In one factory the following points were noticed: At first there was no voltage available, and the automatic cut-out devices came into action. When the switches were closed and the motors were started again, they all ran backwards in the reverse direction at full speed; they amounted in all to 300 kva. It was also found that in two other places, motors of 2.2 kw. and 3.7 kw. ran backwards at full speed. In one place the phases were changed, and the belt was crossed, and it was then found possible to continue work with a circular saw. After rather laborious experiment in the way of division and sub-division of the transmission lines, it was found that the fault was in the power house itself. The oil switch was examined, which connected to the part of the network affected by the disturbance, and it was found that there was a discontinuity in phase II. An insulator that carried the middle contact piece in the oil switch was found to be broken, and the contact piece had fallen to the bottom of the oil case. In consequence of the discontinuity on this phase, this part of the network was only connected through two phases to the power house. —From *Elek. Zeit.*, No. 20, 1916, abstracted in London *Electrician*, Oct. 27, 1916.

Electrophysics and Magnetism

Solid Rectifying Contact.—D. Owen.—An abstract of a (British) Physical Society paper on the influence of the time element on the resistance of a solid rectifying contact. The resistance at a solid rectifying contact, and consequently the exact shape of the resistance characteristic, depends upon the time for which the testing current is allowed to flow. A series of characteristics are given corresponding to duration of contact extending over the range of 1/40,000th second to thirty seconds. The following conclusions are drawn: The variation of resistance with voltage may be attributed entirely to thermal effects. The characteristic obtained by applying the testing voltage for 0.01 second is, at moderate voltages, materially the same as that which would be found at the expiry of a period of the order to 0.000001 second. The sensitivity of a wireless receiving circuit (in which the rectifying contact is used) does not differ very appreciably from that deduced from a slow-period characteristic. An important fraction of the contact resistance resides in a stratum of molecular thickness at the interface of the two elements of the contact, and it is in this region alone that rectifying action at very high frequencies is effected.—London *Electrician*, Nov. 17, 1916.

Electrochemistry and Batteries

Kerr Effect.—S. G. Barker.—An abstract of a (British) Physical Society paper on the application of the Kerr effect to the determination of the saturation values for magnetism of ferromagnetic metals, compounds and alloys.—London *Electrician*, Nov. 17, 1916.

Standardization of Carbon Electrodes for Electric Furnaces.—As a result of war conditions in Germany carbon electrodes for furnaces are now being standardized. According to the new rules round carbons for steel furnaces are to be made in sizes varying in thickness for 100 mm. upward by steps of 25 mm., the tolerance varying from 3 mm. to 6 mm., according to size. For rectangular electrodes used with other kinds of furnaces a standard size of 500 mm. square is proposed. For the time being the standard length is fixed at 2 m., but all lengths may be valued in multiples of 20 mm. Tables for dimensions of threads are under consideration.—London *Electrician*, Nov. 17, 1916.

Electrical Indication of Saline Impurities in Feed Water.—In the *Colliery Guardian*, a recent patent covering an invention for detecting the presence of small saline impurities in feed water is described. A cell, in which the water to be tested forms the electrolyte, is placed in series with an incandescent lamp and connected to the electrical supply. If the liquid is pure no appreciable current will flow and the lamp will not light. But the presence of small quantities of saline impurities renders the liquid conducting and a current passes, causing the lamp filament to glow red. A further indication is afforded by a voltmeter placed across the terminals of the cell. With a practically pure electrolyte this will read only slightly below the supply voltage. But as the impurity increases the diminishing resistance of the cell causes the reading of the instrument to fall steadily, thus furnishing another indication of the amount of impurity present.—London *Electrician*, Nov. 17, 1916.

Miscellaneous

Trade with Russia.—W. H. Beable.—A report of an address on his recent visit to Russia on behalf of the Anglo-Russian Trade Commission. He thinks that some knowledge of the Russian language is absolutely essential in order to travel with any degree of economy and comfort. The principal industrial centers of Russia are discussed. The most pronounced movement in Russia to-day is, and after the war will be, the development of Russia's own manufacturing industries. "The first and greatest demand after the war will be the supply of plant, equipment, machinery, belting and everything that goes to the creation and maintenance of manufacturing industries. On these lines there will be an enormous demand, and while, at the moment, manufacturers cannot do very much, they can at least begin to make inquiries as to the specific lines that will be wanted, and prepare catalogs and information for after the war. It will be some years before the new manufacturing industries will be able to make any appreciable influence, and in the meantime the almost entire depletion of stocks of general merchandise and the great increase in population will offer opportunities unparalleled for British manufacturers to take advantage of now. . . . . Mr. Beable did not pretend that it was possible that Great Britain should capture the whole of the German trade. A great deal, especially of cheaper varieties, will go to Japan; America is taking advantage of her position now to supply large quantities of goods, and is endeavoring to solidify the connections already established. He did not think, however, that America would make a very great impression upon Russia after the war, as the temperament of the American people and American methods were not at all appreciated in Russia, any more than the Russian temperament and methods were adapted to American ideas. Sympathy is the keynote of the Russian character, and it applies to business, as everything else in Russia, and the bond of sympathy with England, created by a common sacrifice, gives this country a great opportunity. It is thought that a safe and profitable trade with Russia can be established on comparatively short terms of credit if precautions are taken in ascertaining bona fide agents and purchasers. The utmost caution should be taken in choosing agents. A possible plan is to send out a traveler or travelers once a year to see whether the business warrants it; this is perhaps the best plan for certain trades. He should, of course, have a very fair knowledge of the Russian language.—London *Elec. Review*, Nov. 24 and Dec. 1, 1916.

X-Ray Tubes.—An illustrated article on the progress made in France with Roentgen ray tubes, and some novel applications, since the beginning of the war. The main part of the article deals with the Coolidge tube and its use in France.—*L'Industrie Elec.*, Oct. 20, 1916.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

D. C. GREEN

D. C. Green, for the last year and a half manager of the Salt Lake City division of the Utah Power & Light Company, has resigned that position to become general manager of the Fort Smith Light & Traction Company of Fort Smith, Ark. This property, which is operated by H. M. Byllesby & Company of Chicago, furnishes the electric lighting and street railway service in Fort Smith and operates an electric interurban railway between Fort Smith and Van Buren. Before taking his position with the Utah Power & Light Company Mr. Green had been connected with the Byllesby company for several years at San Diego, Cal.; Albany, Ore.; Marshfield, Ore., and Everett, Wash. Mr. Green is a graduate of Purdue University, class of 1908.

H. A. Joslin has been appointed local superintendent of the Oregon Power Company at Eugene, Ore.

William Insull has been appointed district manager of the Kentucky Utilities Company at Richmond, Ky.

Arthur H. Young, who has been supervisor of labor and safety of the Illinois Steel Company, Chicago, Ill., has been appointed director of the American Museum of Safety in New York City, succeeding Dr. W. H. Tolman.

E. H. Ramsbotham, for three years superintendent of the New Philadelphia (Ohio) properties of the Ohio Service Company, has been transferred to Hanover, Pa., where he will take charge of the interests of the United Service Company of Scranton, Pa.

W. R. Waggoner of Salina, Kan., president-elect of the Kansas Public Service Association, is the general superintendent of the Salina (Kan.) Light, Power & Gas Company. Mr. Waggoner was graduated from the Case School of Applied Science with the electrical engineering class of 1910. He spent the following eighteen months in the Doherty apprentice school at Denver. In 1912 he took part in the reconstruction of the Doherty property at Montgomery, Ala., and during the next year was superintendent of the gas department at Meridian, Miss. For the past three years he has been general superintendent at Salina, Kan.

P. O. Reyneau has been appointed distribution engineer of the Detroit Edison Company.

H. H. Hermes has been appointed manager of the new business department of the Ottumwa Railway & Light Company, Ottumwa, Iowa.

Lynn R. MacBroom, for the past four years manager of the municipal electric light plant in Burlington, Vt., has tendered his resignation to the Board of Light Commissioners to take effect on Dec. 23. Mr. MacBroom, it is understood, has accepted a position at El Paso, Tex.

Dr. Frederick G. Keyes, who has been associated with the Cooper Hewitt Electric Company for the past two years as chief engineer, has severed his connections to take charge of the research laboratory of physical chemistry at the Massachusetts Institute of Technology. Dr. Keyes still continues with the company in a consulting capacity. R. D. Mailey, who has been Dr. Keyes' assistant, succeeds him as chief engineer. Mr. Mailey will be assisted by Dr. W. J. Winninghoff, formerly of the Massachusetts Institute of Technology research laboratory, and until recently connected with the Anaconda Copper Company.

O. C. TURNER

Oscar C. Turner, eighth Past Jupiter of the Jovian Order, who is the Chicago representative of J. H. Parker & Son, Inc., manufacturers of porcelain, was seriously injured on Dec. 16 when he was struck by a rapidly-moving automobile in Chicago. Mr. Turner's collarbone was broken and he suffered other injuries which it is expected will confine him to the hospital for several weeks.

PAUL LÜPKE

Paul Lüpke, whose annual papers, replete with shrewd philosophy, have been refreshing features of N. E. L. A. conventions for some years past, has just been appointed general superintendent of the Public Service Electric Company of New Jersey, with headquarters at Newark. Mr. Lüpke was born in 1861 in Osenabrück, Germany, and received his education at the local Real-Gymnasium and at the Royal Polytechnic Institute, Stuttgart, Würtemburg. For a time he was connected with the Siemens & Halske Works in Charlottenburg and the Allgemeine Electricitäts Gesellschaft in Berlin. By service in the railroad and telegraph regiment at Berlin and as a one-year volunteer and officer of the reserve he discharged his military duties, and in 1884 came to the United States. Shortly afterward he installed the first arc lighting apparatus at Trenton, N. J., and later entered the service of the local company, with which he has since remained in various capacities throughout various changes and consolidations. Prior to his appointment as superintendent of the system Mr. Lüpke was superintendent of the southern division of the Public Service Electric Company, with headquarters at Trenton, N. J.

James B. Taylor has resigned as superintendent of the municipal electric light plant at Quakerstown, Pa.

Obituary

Walter C. Edson, proprietor of the W. C. Edson Company, manufacturer of electric-light fixtures, Boston, Mass., died Dec. 12 at his home, 39 Liberty Street, Braintree, Mass. He was forty-seven years old. His wife, four sons and a daughter survive him.

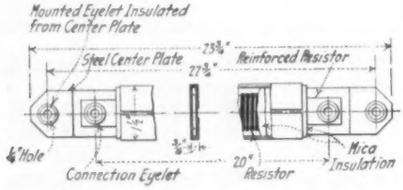
John T. Brady, treasurer of the Denver Gas & Electric Light Company, died of tuberculosis on Nov. 30. Mr. Brady was well known to all the old-timers in the Doherty organization, having started with the Denver company in 1900. Beginning as a bookkeeper, Mr. Brady, by reason of his intimate knowledge of the affairs of the company, rapidly advanced, and for some years had held the position of treasurer.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Units for Heating of Crane Cabs

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has developed a heating unit for outdoor crane cabs that requires little space and provides sufficient heat for the coldest of weather. A heavy perforated



INCLOSED ELECTRIC HEATER UNIT

metal plate is supported about 2 in. from the floor and flat type heating units placed in the air space between the plate and the floor. A warm air current will then circulate up through the perforations. Additional units may be distributed at other points for raising the temperature to a comfortable degree.

The heating units have a capacity of 500 watts and can be used on either direct or alternating-current systems. They are 1.5 in. wide, 3/16 in. deep and 2 ft. long, just like a flat ruler, and can be installed singly or in groups connected in multiple like so many lamps. A steel jacket entirely incloses the nickel chromium resistor, which is in turn inclosed in mica. Standard units are made for 115, 230 and 250-volt circuits.

Mercury Arc Rectifier

Rectifiers that have a range of capacity covering the requirements for

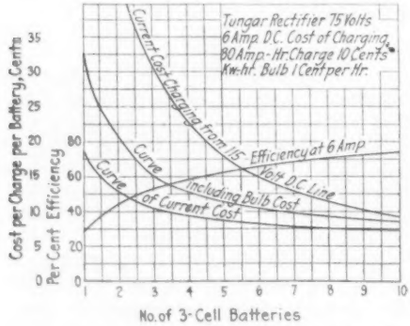

Tungar Rectifier 75 Volts 6 Amp. D.C. Cost of Charging 80 Amp.-Hr. Charge 10 Cents Kw.-hr. Bulb 1 Cent per Hr.
Current Cost Charging from 115 Volt D.C. Line
Efficiency at 6 Amp
Curve Including Bulb Cost
Curve of Current Cost
Cost per Charge per Battery, Cents
Per Cent Efficiency
No. of 3-Cell Batteries

FIG. 1—CURVE OF COST OF CHARGING WITH "TUNGAR" RECTIFIER

motor cycles and those of an automobile service station (from 2 to 6 amp. and from 7.5 to 75 volts) are now being made by the General Electric Company of Schenectady, N. Y.

The "Tungar," as this rectifier is called, operates on a new principle for rectifiers. The discovery that made it possible is the perfection of the small bulb similar to that of an incandescent lamp, in which rectification of the current takes place. This bulb is filled with an inert gas and contains a tungsten filament and a graphite "anode." It screws into a lamp socket in the outfit. These bulbs are inexpensive and good for hundreds of hours of service, it is claimed.

A black-japanned casing with perforated top furnishes the mounting and incloses all live parts. This casing carries the bulb, a fuse to protect against reversal and other overload and the compensator which reduces the alternating current without wasteful resistance

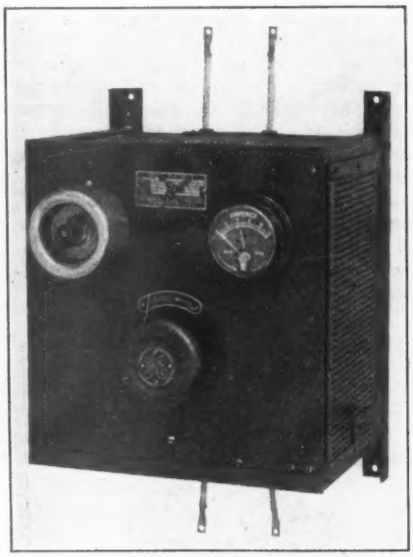


FIG. 2—RECTIFIER WITH LARGE RANGE OF CAPACITY

and excites the tungsten filament. For charging, the rectifiers need only be connected to a convenient lamp socket and the pair of leads attached to the proper posts on the battery. In the public garage type the desired voltage must be set.

The smallest "Tungar" is of 2 amp. maximum capacity. From a 115 volt, 60 cycle alternating current circuit it will charge three lead battery cells at 2 amp., six cells at about 1 amp. and eight cells at 0.75 amp. Between these figures the charging rate is proportionate. The maximum limitation is 125 volts, at which it charges with a slight increase in current output. At minimum of 105 volts, the current output is slightly lower. At 10 cents the kilowatt-hour for current, the cost is about 1 cent the hour, including tube renewal costs. The weight is about 8 lb. Medium size rectifiers have a capacity of 6 amp., 7.5 to 15 volts, and are designed primarily for charging three or six-cell automobile starting and lighting batteries in home garages. This type is designed for 115 volts, 60-cycle current, but may be used on 105 to 125-volt circuits. The weight is about 15 lb. The largest type is designed for use in public garages and service stations, and has a capacity of 6 amp., 7.5 to 75 volts. It will charge from one to ten three-cell storage batteries from a 115-volt, 60-cycle, alternating-current circuit. A compensator with fifteen taps is part of the device and a dial switch for instantly adjusting voltage according to the number of batteries to be charged. Amperage can be regulated between limits of 1 and 6 amp. A single three-cell battery may be charged by itself or any number up to and including thirty cells. The controlling devices, including ammeter, switch and regulating handle, are located on the front of the case. If the alternating current should be interrupted, the batteries cannot discharge but will start again when the current comes.

Light for Victrolas

The neat, ornamental attachment to direct light on the needle point of Victrola tone arms shown here has been developed by the Record-Lite Company, 135 Second Street, Milwaukee, Wis. The light is slipped over the end of a taper tube or tone arm until it snaps into position, where it is permanently fastened. To operate this light the second finger of the left hand rests naturally on the contact spring when operating the machine and the light illuminates the record, where the needle rests. As soon as the hand is removed

ELECTRIC LIGHT ATTACHMENT FOR VICTROLAS

the light goes out. It is claimed that this device prevents the scratching of records and is a convenience when playing a Victrola at night. The light is operated from a battery installed in a suitable box.

Arc Welding System

The Arc Welding Machine Company, Inc., 220 West Forty-second Street, New York City, has developed a constant-current closed-circuit system, which operates arcs in series. This

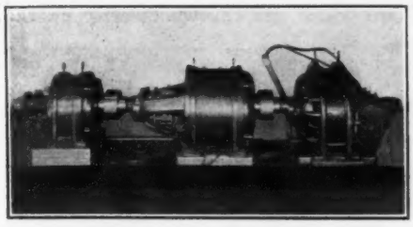


FIG. 1—ARC WELDING SYSTEM GENERATOR

method, it is claimed, has all the advantages of series distribution, namely, the size of wire is uniform throughout the system and carries a uniform current, independent of the length of the circuit as well as of the number of operators. The circuit is simply a single wire of sufficient cross-section to carry the current for one arc, run from the generator to the nearest arc, from there to the next, and so on back to the generator. Wherever it is desired to do welding, a switch is inserted in the line, and a special arc controller provided with suitable connections plugged in across the switch.

The generator consists of two units, the generator proper which furnishes the energy for welding and the regulator, which automatically maintains the current at a constant value. The regulator is excited from a separate source, and by varying its excitation with an ordinary field rheostat, the main welding current may be set, it is claimed, at any value within the range of the machine that is desired, and once set it will automatically main-

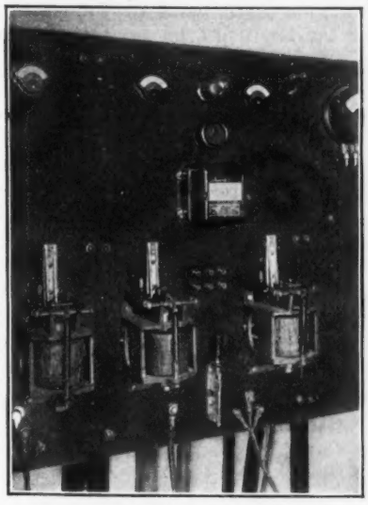


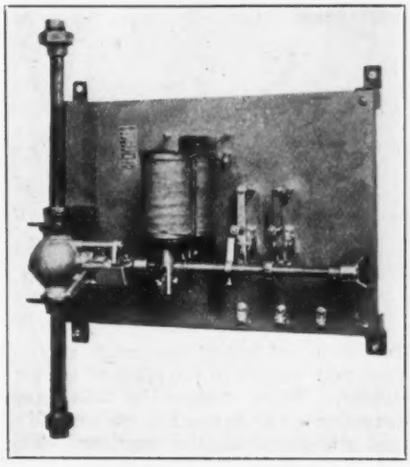
FIG. 2—CONTROL BOARD FOR ARC WELDING SYSTEM

tain that value. The automatic controller for each arc operated on the system serves two essential purposes. 1. It maintains at all times the continuity of the circuit, so that one arc cannot interfere with any of the others when it comes on, or goes out of, the circuit. 2. It controls automatically the heat which can be put into the metal of the weld.

For a given flow of metal through the arc, the temperature of the metal is determined by the length of the arc, that is, by the voltage. With this controller, the length of the arc limited by the voltage is adjusted to suit the work and the operator, and if exceeded the arc is short-circuited automatically, and remains short-circuited until the welder is ready to begin again. Provision is also made for stopping the arc at will without lengthening it. Therefore, it is claimed with this system it is impossible to draw a long arc and burn the metal. Also the arc is not broken when the welding operation is stopped, but is killed by a short-circuit which is placed across it.

Solenoid Operated Valve

The Rowan Electric Manufacturing Company, 308 North Holliday Street, Baltimore, Md., has developed a solenoid operated valve that is constructed on the two-coil principle for use on both al-



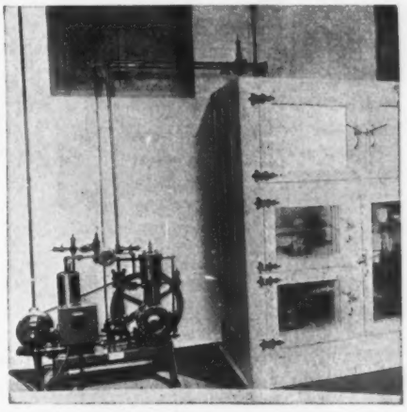
SOLENOID OPERATED VALVE CONSTRUCTED ON TWO-COIL PRINCIPLE

ternating-current and direct-current circuits. One coil is energized to open the valve and the other coil is energized to close the valve, the arrangement being such that current is on the coils while the valve is being opened or closed. Where the valve is operated by a delicate contact-making device, the current of the coils is broken by auxiliary cut-offs shown in the accompanying illustration. In this way the current is broken just as the valve is nearly opened or closed. The valve itself is of such a type that a turn of 45 deg. opens or closes it. It is also balanced and can therefore be installed and operated equally as satisfactorily on high-pressure as on low-pressure lines.

Attention is called to the fact that this valve is so constructed that there is no tendency for it to bind or wedge, making its operation certain at all times. It may be used on air, steam, water and other fluids. Designs are made with a brass body or with an iron body, in sizes from 0.5 in. to 2 in. or more.

Refrigerating Machine

In the accompanying illustration is shown a refrigerating machine made by the McClellan Refrigerating Machine Company of Chicago, Ill. This machine is driven by an electric motor



REFRIGERATING MACHINE FOR HOME USE

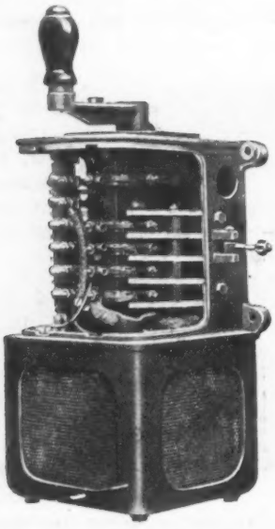
which circulates ammonia through cooling coils in the ice chamber of the refrigerator. This type of refrigerating machine is made in five sizes, driven by Westinghouse motors. The sizes run from 1/15 ton machine, the equivalent of melting 133 lb. of ice per twenty-four hours, to a 1 ton machine the equivalent of melting 2000 lb. of ice in twenty-four hours. Attention is called to the fact, that with this system, refrigeration is accomplished at from one-half to one-third the cost of ice. If run from five to eight hours a day it is possible to maintain a temperature of 40 deg. or less in a well-insulated refrigerator of 30 cu. ft., it is said, at a cost of $1.50 a month, as compared with an ice melting equivalent of from $5 to $7. This system is adapted to all conditions and can be attached to any icebox, making ideal refrigeration possible for homes, markets, stores, restaurants, hotels, hospitals and clubs.

Small Generator for Use on Motorcycle

The General Electric Company of Schenectady, N. Y., has placed on the market a small generator, for use on motorcycles to supply current for head and tail lights. This generator is rated 23.5 watts, 7 volts, and in combination with a regulator will hold this voltage practically constant through a wide range of speed. The generator is totally inclosed and waterproof. It is geared to the engine shafts and at about 1900 r.p.m. cuts in on the storage battery charging the battery at a 3-amp. rate with full field excitation up to approximately 2500 r.p.m. At this point the regulator begins to work and holds the current within 5 amp. up to 9500 r.p.m.

Machine Tool Starting and Regulating Controller

In addition to its new automatic type machine-tool controllers, the Cutler-Hammer Manufacturing Company of Milwaukee has developed a new compact type of drum controller, made in stand-



MACHINE TOOL STARTING AND REGULATING CONTROLLER, WITH COVER REMOVED

ard sizes of 1 to 25 hp. These controllers provide speed regulation by inserting resistance in the shunt field circuit, the armature resistance being designed for starting duty only. The maximum speed range that can be provided is 3 to 1. The armature contact fingers and segments are of solid copper, easily renewable, and are so arranged that dynamic braking is provided when the drum is returned to the off position. The field regulating unit consists of a field resistance commutator mounted on the drum shaft and the necessary field resistance in the form of ferrule type units located in a ventilated case at the end of the drum. They are connected to the commutator through contact clips at each end so as to eliminate all lead wires. Gear or sprocket drive may easily be employed instead of the handle to bring the control to a convenient point, as, for instance, on the apron of a lathe. Protective panels when furnished are mounted upon the frame containing the armature starting resistance.

An Oil Separator

A special oil separator, which, it is claimed, is particularly adapted for use with overloaded engines, where the inadequate capacity of the exhaust pipe for the extra service imposed upon it results in giving the exhaust steam a high velocity and makes satisfactory separation of oil difficult by ordinary separators, has been developed by the Austin Separator Company of Detroit, Mich. A relatively large internal area is obtained by the peculiar flat and oval design of this separator, shown here. Just inside of the inlet a flanged gutter has been constructed to catch the oil, which the maker claims generally gathers upon the lower inner side of the pipe along which it flows under pressure of the steam, and permits this oil to drain down into the receiver. The remaining oil and water, held in suspension by the steam, is impinged against the baffle plate, which is deeply corrugated with circular grooves, as shown in the illustration, all leading to the receiver part of the separator. The outside of the baffle is provided with a high flange edge to prevent water or oil from rebounding over the side.

In size the baffle is designed to meet different conditions and to reduce the velocity to a given point necessary for a thorough elimination of the oil. It is so located as to afford suitable relief for the steam passing around it, that is, overshot and side relief combined. While perfect separation, it is claimed, is provided for as explained, as an extra precaution a ring flange is attached at

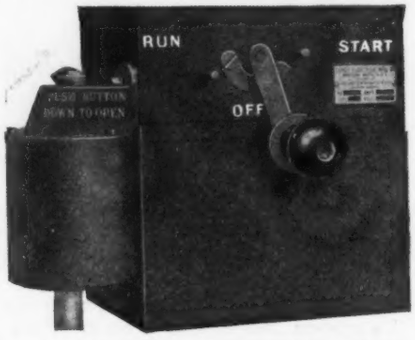
HORIZONTAL SPECIAL OIL SEPARATOR ADAPTED FOR OVERLOADED ENGINES

the point of outlet, to catch any oil that may adhere to the sides of the separator. When stopped by this flange ring the oil is carried down around it and drained into the receiver. This separator is made for use with pipes of from 1.5 in. to 48 in.

Oil Starter for Small Induction Motors

A fused oil switch with resetting under-voltage release for use in controlling small induction motors which are thrown directly on the line without the use of a starting compensator is being manufactured by the Condit Electrical Manufacturing Company of South Boston, Mass. This device is known as the type I oil starter and has been designed to operate under any of the conditions met with in usual practice, providing the starting current of the motors which it is intended to control does not exceed 50 amp. at 440 or 600 volts, or 100 amp. at 110 or 220 volts. The construction of this starter is such that it may be used in the dirty and dusty locations and protect the motor from overload, single-phase running, short-circuits or failure of voltage.

Attention is called to the fact that for safe and satisfactory operation, as well as for economical maintenance of the apparatus, the making and breaking of an alternating-current circuit should take place in oil irrespective of capacity or potential. Because of the heavy starting current taken by induction motors which are thrown directly on the



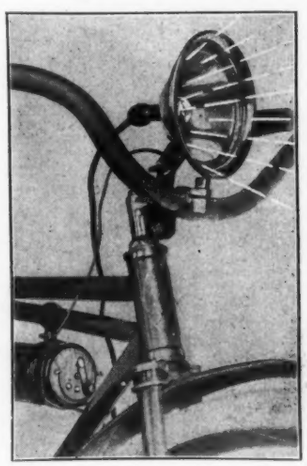
OIL STARTER WITH RESETTING UNDER-VOLTAGE RELEASE

line, fuses are often used whose capacity is far in excess of the normal running current, and the motor is afforded little overload protection under running condition. The use of the oil starter permits the motor to be fused for proper overload protection without blowing the fuses in starting the motor.

The general appearance of the 250 volt type I oil starter with resetting undervoltage release is shown here. It is arranged for wall mounting only.

High-low Bicycle Lamp

In the accompanying illustration is shown a product of A. C. Mannweiler Company, Inc., of Fort Wayne, Ind., a high-low lamp installed on a bicycle. A three-way switch is provided with the outfit, the high point producing 2 cp. and the low point 0.5 cp. The object is



LAMP OUTFIT THAT INCREASES SERVICE OF BATTERY

to operate on low or half candle-power only when a large amount of light is necessary. This, the maker says, enables the batteries to give four times the service regularly obtained when lights are used on a full-point position.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

MUNICIPAL PLANT ACCOUNTING

The Washington Bureau of Inspection Issues New Classifications to Facilitate Good Business Management

The State bureau of inspection at Olympia, Wash., has issued new classifications in connection with its established systems of uniform accounting for municipally owned light and power plants and water works. So far as known, they are the only accounting classifications in any state which are especially designed for the exclusive use of municipally owned utilities. The formulation and revision of this work was accomplished under direction of State Auditor C. W. Claussen, James F. Leghorn, member of the bureau, and Millard Stryker, State examiner. The scope of the work is broad, and embraces the most modern and direct methods which have proved to be practical in actual service tests by the bureau. This is in line with improvements which have continually been made from year to year by the bureau in the accounting for all public institutions, and providing for the constant changes and development involved in public administration and ownership. The purpose of the classification is not only to obtain accurate and comparative accounting, but also to facilitate good business management by making available to the management and the public the most comprehensive information concerning the operation of the departments.

Public Service Commission News

Connecticut Commission

Among the recommendations made by the Public Utilities Commission in its fifth annual report for the year ended June 30, 1916, which has just been submitted to the governor of the state, are the following:

A law directing the commission to prescribe uniform systems of accounts for the several classes of reporting utilities, consideration to be given to the systems prescribed by the Interstate Commerce Commission for companies reporting to that commission.

A law whereby the commission may require companies to make returns for the calendar year instead of for the year ended June 30, as at present, such change in reporting year to be made if and when the Interstate Commerce Commission shall, as is now contemplated, require companies reporting to said commission to report for the calendar year.

That Sec. 1 of Chap. 128 of the Public Acts of 1911, be amended by removing the exception of municipal utilities from the operation of the Public Utilities Commission Act, to the extent of giving the commission jurisdiction over municipally owned utilities operating outside the corporate limits of the municipality.

A law requiring the installation of standard advance signs on line of highway, approximately 300 ft. from railroad tracks, at grade crossings, and providing for the maintenance thereof, substantially in accordance with resolutions adopted by the National Association of Railway Commissioners, at Washington in November, 1916.

In view of the legislation enacted by the 1915 session of the General Assembly, giving the commission jurisdiction over the issuance of securities by the New York, New Haven & Hartford Railroad, the largest public service corporation in the State, the commission suggests the advisability of considering whether or not such authority should be extended over all the utility companies.

California Commission

In a general investigation and valuation of the property of the San Diego Consolidated Gas & Electric Company and an investigation into the reasonableness of its rates and regulations the Railroad Commission made the following findings:

1. The payment of 25 per cent of gross revenues to H. M. Byllesby & Company under the head of supervision is not an expenditure entirely chargeable to operating expenses. Certain items contained therein are more properly chargeable to cost of money, capital account, etc., which, when deducted, would leave a reasonable allowance chargeable to operating expenses of 2 per cent of gross revenues, which amount is allowed.

2. Generators Nos. 5, 6 and 8 being unnecessary in the production of electric energy sufficient to supply all of the demands made upon respondent for service, and earnings having been made sufficient to amortize the capital invested therein, their value is not allowed in establishing a valuation for rate-fixing purposes.

3. The sum of $90,000 is found to be a reasonable allowance for material and supplies, of which amount $35,000 is apportioned to the gas department, the balance to the electrical department. For working capital, gas department, the sum of $55,600 is allowed, and for electrical department the sum of $55,000. Depreciation annuity established on the 6 per cent sinking fund basis.

4. In establishing electric rates an initial block of 500 kw.-hr. is entirely too large.

5. Present rates for gas found to be just and reasonable, as are also rates for electricity, with the exception that the present minimum for general lighting is reduced from $1 to 75 cents per month and general heating rate from 4 cents to 3.33 cents per kilowatt-hour; the monthly minimum for this class of service being reduced from $4 to $3.35. Readjustments are also made in certain schedules for municipal street lighting in accordance with suggestions made by the company.

Missouri Commission

The Public Service Commission has held in connection with the complaint alleging that the rates of the Water, Power & Light Company of Ozark, Mo., were too high that where it appears that an electric utility, investing some $35,000 and having assets of approximately $15,000, has lost some $20,000 on its investment in the eleven years of its existence and that any decrease in rates will probably result in further loss of net income, a complaint as to the reasonableness of rates based merely upon the consumers' desire for lower rates must fail where the utility has in existence rates of 20 cents per kilowatt-hour, with a discount of 25 per cent for prompt payment, and minimum charges not unduly burdensome, although not based upon the size of the meter.

Lower Rates for Birmingham.—The Alabama Public Utilities Commission has approved of the 5 per cent rate reduction for electric lighting proposed by the Birmingham Railway, Light & Power Company.

Reduction in Rates for Youngstown.—The Youngstown-Sharon Street Railway Company has offered a flat rate for Youngstown, Ohio, of 6 cents per kilowatt-hour for light service, with a minimum charge of 50 cents. The present rate is 7.5 cents, with a minimum charge of $1. The company is seeking a twenty-five-year franchise.

Company Asks Permission to Reduce Its Service Rates.—The Logan, W. Va., Light & Heat Company has applied to the Ohio Public Utilities Commission for authority to reduce the rates charged consumers in that State for service. The reduction is to become effective on Jan. 1, and it is said the rates range from 50 to 75 per cent of the present schedule. The company explains that through the enlargement of its plant it can supply patrons at much smaller cost.

Nitrogen Fixation Plant for Washington.—The American Nitrogen Products Company, Seattle, Wash., recently closed a contract with the Tacoma municipal power system for necessary energy to operate the first unit of a nitrates plant which the company is erecting at La Grande, Wash., at a cost of approximately $500,000. The company will extract nitrates from the air, from which will be taken the products used in fertilizer, explosives, dyestuffs, etc. The company filed on a huge power site on the Suak-Suiattle River, 50 miles north of Everett, several years ago, and intended to build its industry there, but, pending the decision of the Seattle municipal lighting department as to the advisability of the site for municipal power purposes, decided not to wait until the city of Seattle had waived its claim to the power rights.

Companies Responsible If Safety Rules Not Enforced.—The California State Accident Commission recently ruled that a company is responsible for accidents caused by its employees' nonobservance of safety rules. The decision was made in the suit brought by George H. Matthews against the Southern California Edison Company, of Los Angeles. One of this company's rules is that a man shall wear a safety belt when higher than 5 ft. from the ground, and also that linemen wear rubber gloves. Matthews was thrown from a 50-ft. pole by a slight current of electricity while working on what he thought was a "dead" wire. He was not wearing a safety belt and, according to the findings of the commission, the foreman of the company knew that Matthews and other employees were violating the rules, and the company was held liable for his injuries, which would probably have been slight had the safety belt been used. Matthews was awarded $520 in cash, $14.06 a week until further orders, and the company was also directed to provide him with proper medical and surgical attention.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Injunction Secured Against Striking Linemen.—On Dec. 14 Judge J. M. Killits of the United States District Court for northern Ohio issued an injunction restraining striking linemen of the Ohio State Telephone Company at Toledo from interfering with repair work. Lines have been cut frequently and the business houses and citizens have been greatly discommoded. Strikers would not allow workmen to repair the lines and kept things in a turmoil generally. United States marshals and the city police force are now in charge of matters to prevent any further trouble.

New Substation and Service Building for Minneapolis.—The Minneapolis General Electric Company has started construction of a new substation and service building in Minneapolis. The building will have a 375-ft. front and extend back 200 ft., and will consist of a basement and two stories at the present time with adequate foundations for the addition of three stories later. When completed about April 1, 1917, there will be housed in the building a power substation, a large warehouse, a repair shop, supply depot and garage. The structure will cost approximately $250,000, not including additional stories to be added subsequently.

Noteworthy Christmas Signs at Providence.—Unusually distinctive electric signs for the electrical Christmas trade are now in service at the Providence, R. I., appliance store of the Narragansett Electric Lighting Company. The proverbial figure of Santa Claus, in heroic size and studded with colored lamps, is located over one display window, while the opposite one is surmounted by an electrically illuminated

DISTINCTIVE CHRISTMAS SIGNS

Christmas tree, which is depicted hung with electric heating appliances instead of the usual nondescript holiday products, and the two signs, facing one of the busiest streets in the city, have attracted widespread attention. Each is equipped with about 200 10-watt tungsten lamps.

Drying Out Motor With Electric Radiator.—An interesting application of a 600-watt electric radiator was recently worked out when it became necessary to dry out a 3-h.p. two-phase motor that had been used in water for twenty-four hours in the subcellar of a Yonkers, N. Y., store. The rotor and stator coils were removed and placed on a sheet of asbestos with the 600-watt electric radiator and the group then covered with asbestos and canvas. After a twelve-hour period of baking the coils tested 800,000 ohms to ground and the motor ran perfectly when reassembled.

Old Aluminum Test Line Gives Way to Copper.—The old aluminum Madison River power line of the Montana Power Company, erected sixteen years ago, between Madison Canyon and Butte, to test the comparative cost and utility of copper and aluminum, and to determine the serviceability and practicability of aluminum as a substitute for copper, for transmission lines, is being torn down and replaced with copper wire. The aluminum in this line, which extends for a distance of sixty miles, has become too soft for efficient service, according to F. M. Kerr, general superintendent of the company.

Oldest Cooper-Hewitt Lamp Still Fit for Service.—After having been in constant use for eleven years, eight months and seven days, the oldest type of Cooper-Hewitt lamp in existence and still fit for further service, has been returned to the manufacturer by Dr. E. L. Elmendorf, the celebrated traveler and lecturer. It was returned with the original tubes, both of which are still in good working order, the vacuum being intact though the glass was slightly discolored from use. The lamp has been used in connection with the making of lantern slides from photographic negatives, enlarging and reducing negatives, making small and large positives on glass or on paper, and for illuminating flowers, copies, maps, machinery; in fact everything that Dr. Elmendorf has had occasion during the twelve years to photograph indoors.

A. T. & T. Meets Rising Cost of Living With Bonuses.—A distribution of more than $6,000,000 to the employees of the Bell Telephone system to aid those whose incomes are not keeping step with the increased cost of everything will be made soon by the American Telephone & Telegraph Company, according to announcement made by President Theodore N. Vail. This payment will be in addition to wage increases for demonstrated merit and the readjustments usually made at this time of year. The equivalent of three weeks' pay will be given to those receiving $3,000 or less a year who have been in the employ of the company a year or more. Two weeks' pay will be given those employees who are earning less than $3,000 a year and have not been with the company for one year. Bonuses not yet determined will be distributed among those employees whose salary is between $3,000 and $5,000 a year.

Portable Lighting Plant for Night "Movie" Photography. — A portable lighting plant capable of supplying 218 amp. at 120 volts, and mounted on a 5-ton automobile truck is used by the Vitagraph Company for lighting their outdoor night motion-picture scenes at locations where it is not possible to tap distribution circuits. The generator is driven by a 50-hp. marine engine. Indoor studio arc lamps are used.

High Price of Fuel and Materials May Endanger Cleveland 3-Cent Light. —In a newspaper interview on Dec. 18, Light Commissioner Davis of Cleveland, Ohio, stated that if prices of material and fuel continue to increase, it will be impossible to operate the municipal light plant at a flat rate of 3 cents. Mr. Davis received bids for a new boiler recently and found that it will cost almost twice as much as it could have been secured for three years ago. Many other things have increased in price proportionately, he said, and the operating expenses of the plant are gradually creeping up.

Electric Vehicles in Commonwealth Edison Service.—The Commonwealth Edison Company has now in service 144 electric vehicles for all classes of service. Eight of these electrics are employed for passenger service, the latest one of which is capable of making a speed of 22 miles per hour and going 60 miles on one charge. This electric is being used by the customers' service and repair department of the company.

Commercial Preparedness for After War Trade—The fourth national Foreign Trade convention will be held at Pittsburgh Jan. 25, 26, 27, 1917, and will consider among others the following questions: "Conditions in Foreign Markets After the War, and the Measures Necessary to Safeguard American Foreign Trade, as Well as the Foreign Trade Aspect of the American Tariff System"; "Co-operation in Foreign Trade Development"; "Foreign Investment of American Capital as an Aid to Oversea Commerce"; "Problems of the Smaller Manufacturer and Merchant."

Vancouver May Undertake Power Development.—The intention of the city of Vancouver, B. C., to enter into the power development business was disclosed at a recent meeting of the city council, when a draft agreement, prepared by the city solicitor, in connection with an option for obtaining all the rights to a large proposed power plant on the Bridge River, near Lillooet, about 150 miles from the city, was discussed. The city secures the option for the sum of $40,000. The meeting held recently took up various phases of the proposal, one of the chief of these being the placing of the city in a position of independence at the expiration of the present agreement between the city and the British Columbia Electric Railway Company in the year 1919, when the contract between the city of Vancouver and the company expires. Application will be made to the Legislature at its next session for an amendment to the city charter to enable the city to enter into the power development business.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Requirements of Modern Business.—The 179th meeting of the Schenectady section of the American Institute of Electrical Engineers was held on Dec. 21. C. E. Patterson, comptroller of the General Electric Company, addressed the meeting on "Some Requirements of Modern Business."

New Officers of Memphis Jovian League.—C. K. Chapin has been re-elected president of the Jovian League of Memphis, Tenn. Other officers are as follows: First vice-president, Burns Stewart; second vice-president, Joseph A. Fowler; third vice-president, William Slater; secretary, Hugh G. Street; treasurer, Andrew Myers.

Pittsfield Dinner and Dance.—The second annual dinner and dance of the Pittsfield section A. I. E. E., was held at the Wendell Hotel on Dec. 12. The regular meeting of the section was held on Dec. 14, when W. B. Potter, chief engineer railway and traction department, General Electric Company, read a paper on the topic "Electric Transmission for Motor Cars."

Electric Social Club Annual Banquet. —The third annual banquet of the Electric Social Club, Greenfield, Mass., was held on Dec. 7. The membership of the club is made up from employees of the Greenfield Electric Light & Power Company, the Turners Falls Power & Electric Company, the Franklin Electric Light Company, the Amherst Gas Company, the Easthampton Gas Company, the Agawam Electric Company and the Ludlow Electric Light Company.

Minnesota Engineers Hear Paper on Transmission Economies.—The December meeting of the Minnesota section A. I. E. E. was held at the University of Minnesota, Minneapolis, on Dec. 18. Lincoln Nissley, electrical engineer, Northern State Power Company, presented a paper entitled "Transmission Economies and the Insulator Problem." The university branch of the institute made a 300,000-volt insulator test—corona and flashover, and also made a demonstration at 125,000 cycles of a several million volt Tesla coil.

Providence Engineering Society.—The society has recently been reorganized with the following officers: President, Prof. J. Ansel Brooks; vice-presidents, Robert W. Adams, George A. Carpenter, Wayland T. Robertson; recording secretary, William A. Kennedy; corresponding secretary, Albert E. Thornley, Narragansett Machine Company, Pawtucket, R. I.; treasurer, Alfred H. Whatley. Meetings are being held monthly. On Dec. 27 Frederick H. Newell, professor of civil engineering at the University of Illinois, and former director of the Reclamation Service of the United States, will deliver an illustrated lecture on the "Work of the Reclamation Service." On Jan. 24 W. S. Franklin will give an address on "Some Mechanical Analogies in Electricity and Magnetism." For the meeting of the society on Feb. 28, Dr. Miller Reese Hutchison will be the speaker.

Kentucky Utilities Association Elects Officers.—Harry Reed of Lexington, president of the Kentucky Utilities Company, was elected president of the Kentucky Association of Public Utilities at the recent annual convention held in Louisville. Mr. Reed succeeds F. W. Bacon, vice-president of the Lexington Utilities Company. Philip S. Pogue, general manager of the Louisville Home Telephone Company, was elected first vice-president; W. L. Weston, of Paducah, second vice-president, and James B. Riley, of Louisville, was re-elected secretary and treasurer. One day only was given to the convention this year, instead of three, as usual. About eighty of the public utility men of the state were represented. Workmen's compensation insurance in Kentucky was one of the important matters considered at the convention. Speakers included J. A. Brett, of the Westinghouse Electric Manufacturing Company; W. W. Freeman, president of the Cincinnati Union Gas & Electric Company, and H. Wurdach, president of the Cupples Station Light, Heat & Power Company, St. Louis.

Marine Electricians Form Association. —An informal meeting of marine electricians was held at Lorain, Ohio, on Dec. 14, 15 and 16. "The Standardization of Marine Electrical Fixtures," "The Use of Central Station Power for Ship Yards and the Disadvantages of the Present Methods of Charging for Current" were among the interesting subjects discussed. Visits were made to the plants of the American Shipbuilding Company, Lorain, Ohio, the Electric Control & Manufacturing Company, Cleveland, Ohio, the Hickock Electrical Instrument Company, and the Pittsburgh Steam Ship Company's new 600-ft. steamer, *D. M. Clemson*, which has just been completed at the Lorain yards of the American Shipbuilding Company. It was decided to effect a permanent organization, to be known as "The Association of Marine Electricians." The following committee was appointed for this purpose: E. L. Howarth, C. E., American Shipbuilding Company, Cleveland, Ohio, chairman; A. R. Martin, C. E., Buffalo Dry Dock Company, Buffalo, N. Y.; A. B. Walton, C. E., American Shipbuilding Company, Lorain, Ohio, secretary; Frank Yager, C. E., Chicago Shipbuilding Company, Chicago, Ill.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LAMP PATENT LICENSES

Authority to Manufacture Granted to Two More Independents, Others to Follow Soon

Licenses to manufacture electric incandescent lamps under the Just and Haverman patent have been granted by the General Electric Company to two more independent manufacturers, the Weehawken (N. J.) Tungsten Lamp Company and the Vosburg Miniature Lamp Company, Inc. These, together with the Lux Manufacturing Company, constitute the only independents licensed to date. Four other licenses, it is understood, are practically ready for signature and in the event nothing unexpected happens should be granted within the next week or ten days.

THE EFFECT OF MARKET CONDITIONS ON CREDITS

Central Stations Must Satisfy Manufacturers of the Wisdom of Making Improvements at the Present High Prices for Materials

Higher prices and greater stocks ordered in anticipation of delayed deliveries have given credit men in the electrical line considerable to think about. There is little doubt but that credits have been shortened and conditions generally tightened. But so far as could be found no fixed credit policy exists in the industry other than to treat each case separately and extend credit that seems justifiable.

A contractor who last year received a credit for $500 this year might purchase $5,000 worth of goods or be restricted in his purchases to less than $500. If the contractor is apparently a good business man and is making headway he will be granted better credit terms than one who is careless, unbusinesslike and inefficient. The same conditions apply to the dealer.

In extending credit to central stations manufacturers are more careful than ever before. A central station must convince the manufacturer of the wisdom of the purchase of equipment at the present high prices before he will extend much credit. If it were only the purchase of electrical equipment it would probably be a different matter, but a large purchase of electrical equipment means generally the purchase of so much more material of different kinds that the total credit risk becomes very high.

A number of smaller central stations have been forced in the past twelve months by the character and size of the load to rehabilitate their plants almost entirely. In such cases the manufacturers are very careful in extending credit and in most cases like this probably take some measure like a chattel mortgage on the equipment to insure themselves.

As evidence of the tighter credit conditions are the collections. Reports from every direction show that collections are large and in an excellent state.

ELECTRIC DRILL USE INCREASING

Manufacturers Rushed with Orders as a Result of the Prevailing Industrial Activity

Electrical portable drills are finding a much wider use to-day than two years ago. Manufacturers have more orders than they can conveniently handle and it is known that one manufacturer has purchased a large tract of land preparatory to building another factory, owing to the increased demand.

The price of drills has advanced with the market for raw materials. Deliveries have been as good as could be expected. Those manufacturers who purchased their motors, as practically all of them do, have had difficulty in maintaining their stock and have, therefore, been handicapped in making quick deliveries.

ACTIVITY IN BUILDING OF ELECTRICAL FACTORIES

Number of Plants of Considerable Proportions Now Under Construction—Almost Every Line Is Represented

At the present there is probably more factory buildings to be devoted to the manufacture of electrical products under construction, just completed, or about to be constructed, than ever before in the history of the industry. Some of the plants are of considerable proportions. Only last week it was announced that construction work on a new plant, to cost in the neighborhood of $7,000,000, was about to commence. This plant, it seems probable, will be devoted to the manufacture of turbines, generators, and other heavy power equipment. Other plants, smaller in size, are being erected in every section of the country. Reports have come to the Electrical World of new factories for almost every line of electrical manufacture, some of which for the first time are housed in separate factories.

In addition to new buildings, there has been a comprehensive program for additions to existing factories.

It is significant that so much new factory building should be in the early construction stage at this time. Factories have been running night and day for some time and orders have piled up until unfilled orders would keep many of the plants on full time for months to come. That this condition will continue for a few years at least, and is not contingent upon war, seems to be the opinion of most manufacturers, as witness their answer with increased factory space.

COPPER SLIGHTLY LOWER

Market Reacts on Peace Proposals—Early Deliveries Most Affected

Although showing considerable and somewhat unexpected strength on the proposal for peace offered by the Teutonic Allies for a few days, the copper market was apparently unable to stand the strain any longer. December copper is more than a cent lower than the high price of a week ago, and on Tuesday following the declaration of the position held by England regarding Germany's proposals December electrolytic was quoted at 34 cents bid, 34 5 cents asked. January copper was quoted at 32.75. Quotations for 1917 were as follows: First quarter, 32.25; second quarter, 31.25; third quarter, 30.25, and fourth quarter, 29.75. As will be noticed, the greatest reaction was in copper for early delivery. Copper for last quarter 1917 delivery was affected least of all.

While the reaction has not been great, there is considerable uneasiness among the buyers. Every day there appears on the market a number of small lots up to 200 and 300 tons of spot copper. How much more of this resale copper is held is not known. It is well known that producers are sold out, but it had generally been understood that practically all sales had been made to consumers and the volume of copper held for speculation was exceedingly small.

Copper wire manufacturers and manufacturers of electrical goods stand in a very unsatisfactory position should there be a large amount of copper available for speculation. Stocks were laid in at top-notch prices, and in many cases these stocks were very substantial. Both wire and electrical manufacturers have orders on their books for deliveries way into 1918, and unfilled orders would keep the factories going night and day well through 1917, and great care was taken to prevent any uncertainty of delivery through lack of raw materials.

PEAK REACHED IN MARKET FOR INCANDESCENT LAMPS

Production to Remain at Maximum Until Reserve Stocks Are Again Replenished—Hesitancy in Opening New Export Accounts.

For some time the production of incandescent lamps has been below the volume of incoming orders and manufacturers have had to reduce their stock reserves until the shelves are practically bare. Formerly all orders were filled from stock. This stock was, as a rule, equal to from 20 to 30 per cent of the anticipated twelve months' demand. Now, however, orders are filled from production.

The market for lamps is now at its height and will probably stay at its peak for another month, after which incoming orders will probably be less in volume. Production also is at its peak and will continue at capacity until long after the peak of the market is passed. For some time production will be no more than sufficient to take care of incoming orders. When the volume of incoming orders falls below production then the manufacturers will probably employ surplus production to replenish the stock reserves.

All customers, it is understood, are being taken care of, and in the case of some large central station customers the reserves are being kept up. Jobbers have been inclined to overstock and to that extent lamp manufacturers have frequently found it difficult to determine just how large a stock a particular jobber should be allowed to carry.

Industrial activity has been the dominant feature in this market for lamps. Where formerly factories used artificial lighting only during a few hours daily in the winter months, they are now using artificial light twelve to sixteen hours daily.

Export inquiries continue to be large, but owing to the size of the domestic market no very substantial attempt is being made to supply other than old customers. Very few new accounts are being opened and where they are opened there is every reason to believe that the American manufacturers expect to retain this business after European competition shall start again.

Production has fallen behind principally because of the inability to procure for some time some indispensable manufacturing materials. The manufacturers, while now able to receive supplies satisfactorily, have never fully caught up from this enforced inactivity in production.

COAL SHORTAGE MAKES POWER EQUIPMENT MARKET

Isolated Plants, Unable to Obtain Fuel in Sufficient Quantities and at Satisfactory Prices, Accept Central Station Service

The coal shortage which has carried the attention of the country for the past month or two is visibly affecting the electrical industry. Many factories having their own plants have been forced by the coal shortage and the practically prohibitive prices to use central station service. From this condition a very considerable market for electrical supplies has sprung up. Since the shortage has really only just begun to be felt by the majority of isolated plants, there is every reason to believe that as the situation grows more acute that more and more isolated plants will accept central station service.

The shortage is probably felt most on the Eastern coast, particularly in New England. Each succeeding report shows a large net shortage of freight cars and the early snows have held up many shipments. The central stations, it is understood, are well protected.

MORE POPULAR PRICES FOR PASSENGER ELECTRIC

Manufacturers Put New Models on the Market, at the Same Time Retaining the Higher-Priced Models

Ever since the Philadelphia convention of the National Electric Light Association in 1914 there has been an agitation for an electric passenger car of a less expensive model than those on the market. At that time Dr. C. P. Steinmetz pointed out the reasons why a low-priced electric would come eventually and what it would mean to the central stations. Manufacturers could not be convinced because they believed the sale of electrics would come only from the wealthy class and that with this trade price was of little importance. It was firmly believed by distributors that the electric without its gorgeous fittings would find no market.

Little by little this viewpoint has changed. Some manufacturers who would not change, however, are no longer manufacturing pleasure electrics. Recently there were brought out two models for under $2,000, and but a few weeks ago it was announced that there would be exhibited at the annual New York Automobile Show in January a model to sell for around $700.

These prices are revolutions in the passenger electric field. Should the sale of these models come up to expectations it is very likely that other low-priced cars will follow. A wide sale of electric cars will mean the sale of more batteries and more charging outfits, besides the other smaller pieces of electrical equipment.

EXPORT TRADE CREDIT

Difficulty in Obtaining Satisfactory Rating Responsible for Many Orders Being Held Up

Although there are almost numberless inquiries from abroad for electrical equipment, the business actually accepted is very limited, and this is so principally for two reasons. In the first place, the domestic market is large enough to absorb all of the electrical merchandise that can be manufactured in this country and then be unsatisfied. In the second place, the information that the credit man wants is not always available or is entirely unsatisfactory.

The first condition needs no explanation, but the second one opens up a state of affairs about which little is known.

Where manufacturers have agents abroad there is no trouble. The agent looks after all the risk. He pays the manufacturer according to an agreement and collects from the customer. Where there are no agencies, and this is the case with practically all of the smaller electrical manufacturers and of the larger ones in many countries, the manufacturer either deals direct with the customer or through a commission house. Of the first class there is a large amount of business pending just now and in many cases it is not a matter of price, but only one of credit.

The credit man is put to it to obtain satisfactory information, particularly about South American buyers. Germany and England had no trouble before the war because of local branches of home banks. These banks looked after the home manufacturers' welfare. The American manufacturer has not these banks to rely on. South American banks render unsatisfactory and frequently untrustworthy statements. Agency ratings are seldom of a date nearer than twelve months and then do not give what the American manufacturer will accept as a basis for credit.

One case in particular is recalled that opened by an inquiry last March. The order has not been placed because of too vague credit information. A large amount of time was spent in trying to obtain this information and the indications are that if a satisfactory report is obtained it will not be before next March. It is therefore evident why many of the foreign inquiries for electrical goods never result in orders.

Manufacturing and Industrial

Federal Sign System (Electric) has moved its New York office and factory from 1790 Broadway to 627 West Forty-third Street, New York.

The Storage Battery Supply Company, 239 East Twenty-seventh Street, New York City, celebrated its twenty-fifth anniversary on Dec. 15.

The General Bakelite Company has removed its New York office to 2 Rector Street, where it has larger and better arranged quarters to assist materially in handling the increasing business.

The Lapp Electric Manufacturing Company will commence work soon on a factory at Le Roy, N. Y., for the manufacture of transmission line insulators. The company is capitalized at $150,000. John S. Lapp of Victor is general manager.

Trump Manufacturing Company, Springfield, Ohio, has increased its capitalization from $100,000 to $125,000. The increase was voted to enable the company to take care of an increase in business arising partly from the manufacture of a new type of water wheel.

The Sothman Corporation has been formed with offices at 40 Exchange Place, New York City. The new organization is the outgrowth of the consulting firm of P. W. Sothman & Company and was formed to enable the organization to extend its scope to include actual construction.

Cincinnati Storage Battery Company, 228 Stark Street, Cincinnati, Ohio, manufacturer of automobile starting and lighting batteries, has recently been incorporated with the following officers: President, A. H. Luhrman; vice-president, Henry Luhrman; secretary-treasurer, William T. Foley.

J. W. Bryant, formerly branch manager of the Wagner Electric Manufacturing Company at Buffalo and Syracuse, N. Y., is now district manager for the company, with headquarters at Cincinnati, Ohio. C. P. MacGonigal is now branch manager of the company, with headquarters at Buffalo and Syracuse, N. Y.

William G. Merowit, who recently returned to New York City from the Milwaukee factories of the Cutler-Hammer Manufacturing Company, has been appointed representative for the Cutler-Hammer line of control apparatus in New York State and Canada. For the present his headquarters will be at the New York Office of the company, 50 Church Street, New York City.

O. J. Gude Becomes Chairman of Sign Company Board.—At a meeting of the board of directors of The O. J. Gude Company, N. Y., Dec. 18, O. J. Gude resigned as president of the company to become chairman of the executive committee, his financial interests remaining unchanged. W. F. Wentz, formerly second vice-president and general manager was elected president. The board of directors and other officers remain the same.

Johns-Manville Gives Employees Bonus.—Every employee of the H. W. Johns-Manville Company who has been with the company a year or more was gladdened by the receipt of a Christmas greeting signed by President T. F. Manville announcing the board of directors' decision to give a bonus equal to 10 per cent of the year's salary. This action was prompted by the very satisfactory earnings of the company in 1916 and the splendid service rendered by the employees.

Turner Engineering Company, consulting and constructing electrical engineers, has opened temporary offices in the Dime Savings Bank Building at Detroit. The new organization is headed by Waldso Turner, who for many years was vice-president of the Iron City Engineering Company and in active charge of both their Pittsburgh and Detroit offices, the latter having been started by Mr. Turner in 1912. The new company in addition to having ample financial support, it is stated, already has close to $250,000 worth of work under contract.

The SKF Ball Bearing Company, Hartford, Conn., announces that S. B. Taylor, sales manager, has been appointed vice-president of the company succeeding F. K. Kirkbride, who remains on the board of the company. Mr. Taylor will remain in charge of sales. G. A. Ungar, former representative of the company in Cleveland, Detroit and Pittsburgh, has been appointed technical manager and chief engineer succeeding Uno Forsberg, who returns to Sweden after completing his work of creating the manufacturing organization of the SKF Ball Bearing Company in this country.

NEW YORK METAL MARKET PRICES

	Dec. 12 Selling Prices Bid	Dec. 12 Selling Prices Asked	Dec. 19 Selling Prices Bid	Dec. 19 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	148 0 0		142 10 0	
Prime Lake	34.50 to 35.00†		32.00	to 32.50†
Electrolytic	35.00 to 35.50†		34.00	to 34.50†
Casting	33.00 to 33.50†		31.00	to 31.50†
Copper wire base	40.00†		40.00†	
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	12.05 to 12.30		10.17½ to 10.67½	
Tin, straits	43.00		42.50	
Aluminum, 98 to 99 per cent	59.00 to 61.00†		59.00	to 61.00†

OLD METALS

Heavy copper and wire	27.00 to 28.50†		27.00 to 29.00†	
Brass, heavy	17.00 to 18.00†		16.00 to 17.50†	
Brass, light	13.00 to 13.25†		13.00 to 13.25†	
Lead, heavy	6.75 to	6.87½†	6.75 to	6.87½†
Zinc, scrap	8.50 to	9.00†	7.00 to	8.00†

COPPER EXPORTS

Total tons to Dec. 19 14,040

†Nominal.

Corporate and Financial

Carolina Power & Light Company, Raleigh, N. C.—An initial dividend of 1 per cent has been declared, payable Feb. 1 to stockholders of record Jan. 16.

Detroit, (Mich.) Edison Company.—A block of $1,500,000 of 5 per cent first and refunding mortgage gold bonds due July 1, 1940, is being offered at 101.5 and interest. The amount outstanding is now $7,000,000.

Kentucky Utilities Company, Lexington, Ky.—The company has purchased the plant of the Glasgow (Ky.) Electric Light & Ice Company, at a price understood to be about $100,000, and will take a twenty-year franchise from the city. It is announced that the utilities company will establish a central station at Glasgow and transmit power to surrounding cities.

Knoxville (Tenn.) Railway & Light Company.—A block of $1,556,000 of refunding and extension mortgage 5 per cent gold bonds due June 1, 1946, is being offered at 92.75 and interest, to net 5.5 per cent.

Lorain (Ohio) County Electric Company.—The company has purchased the property of the Citizens' Gas & Electric Company, and on Dec. 4 both companies filed applications with the Ohio Public Utilities Commission for permission for the consolidation. The purchase price was given as $250,000. The Lorain County Electric Company is controlled by the Henry L. Doherty Company. It owns a big central station on the lake front and supplies energy for Lorain, Amherst, South Amherst, Olmsted Falls and Berea. Plans have been made to double the capacity of the plant by the addition of a 12,000-hp. turbine and four additional boilers of 500 hp. each.

Northern States Power Company, Chicago, Ill.—The board of directors has declared the usual quarterly dividend of 1.75 per cent on the preferred stock of the company, and has declared a dividend of 1.75 per cent on the common stock, which is an increase of 0.25 per cent. The preferred stock dividend is payable on Jan. 15 and the common stock dividend is payable on Jan. 20, to stockholders of record Dec. 30.

Ohio Gas & Electric Company, Cincinnati, Ohio.—A limited amount of first mortgage 6 per cent bonds due 1946 is being offered at 103 and interest.

Southern Canada Power Company, Drummondsville, Quebec.—An issue of $400,000 of 6 per cent first and refunding mortgage sinking fund gold bonds due Sept. 1, 1948, is being offered at par with a bonus of 50 per cent common stock.

Standard Gas & Electric Company, Chicago, Ill.—Directors of the company have declared a dividend of 1.5 per cent on the preferred stock for the quarter ending Nov. 30, payable Dec 15 to stockholders of record Nov. 29. This is an increase of one-half of one per cent over the quarterly dividends recently paid.

New Utility and Industrial Companies

The American Insulator Company of New Freedom, Pa., has been chartered with a capital stock of $150,000 by H. C. Kugler and others.

The La Mese (Tex.) Light & Power Company has been incorporated with a capital stock of $6,000 by E. F. Cox, R. B. Red and M. C. Lindsey.

The Arrow Electrical Contracting Company of New York. N. Y., has been incorporated with a capital stock of $500 by M. Schwartz, A. Bikales and M. Cardos.

The Andover (Ohio) Electric Light & Power Company has been chartered with a capital stock of $15,000 by C. E. Harman, C. W. Wood, V. M. Cole, F. J. Bishop and William Webb.

The St. Mary's (W. Va.) Power & Light Company has been incorporated with a capital stock of $25,000 by Gilbert Mead of St. Mary's, E. W. Mallory of Parkersburg, W. Va., and others.

The Ohio River Power Company of Columbus, Ohio, has been chartered with a capital stock of $10,000 by Harry M. Daugherty, Frank Espy, R. L. Buffington, E. S. Browne and F. C. Morrison.

The Wheatland (Ind.) Light Company has been incorporated by A. C. Nicholson, J. S. Nicholson and A. E. Nicholson. The company is capitalized at $2,000 and proposes to operate an electric light plant.

The Jewel Lamp Company of Newark, N. J., has been incorporated by Joseph J. Steinharter, Joseph and Samuel E. Hollander. The company is capitalized at $125,000, and proposes to manufacture lamps, etc.

The Standard Signal Tail Light Company of Cleveland, Ohio, has been incorporated by A. A. Stambaugh, S. C. Elliott and others. The company is capitalized at $50,000 and proposes to manufacture vehicle signals.

The Iaeger (W. Va.) Water, Light, Power & Development Company has been incorporated with a capital stock of $25,000 by James A. Strother, B. F. Williams, M. S. Taylor of Welch, W. Va., and W. R. Iaeger of Ware Neck, W. Va.

The Electrical Welder Company of Lynn, Mass., has been chartered, with a capital stock of $850,000. The directors are: Carl L. Felton, president; Eugene T. Connolly, 84 State Street, Boston, Mass., treasurer, and David J. Lyne.

The Kilo Electric Meter Company of Indianapolis, Ind., has been incorporated with a capital stock of $40,000 to manufacture electrical appliances. The incorporators are: Claude L. Marshall, Gustave A. Schaffer and William T. Wann.

The Pittsburgh (Pa.) Visible Spark Plug Manufacturing Company has been incorporated with a capital stock of $50,000 to manufacture spark plugs. The incorporators are: William Boyd Winloft and Charles H. Jones of Wilmington, Del.

The Standard Electric Manufacturing Company of Indianapolis, Ind., has been chartered with a capital stock of $100,000 to manufacture and deal in electrical devices. The incorporators are: Earl C. Applegate, David A. Frew and B. Frank Hall.

The Fore Electrical Manufacturing Company of St. Louis, Mo., has been incorporated by Albert Wehmeier, J. H. McEwen and L. R. Brown. The company is capitalized at $10,000 and proposes to manufacture electrical tools, devices and appliances of all kinds.

The Fuse Electric Fire & Burglar Fire Alarm Company of Wheeling, Mo., has been incorporated by A. E. Lowe, Thomas J. Lilly and W. S. Cherry. The company is capitalized at $30,000 and proposes to manufacture and sell fire and burglar-alarm systems.

The Canajoharie (N. Y.) Supply Company has been chartered by B. Arkell, W. H. Lipe and W. J. Roser of Canajoharie, N. Y. The company is capitalized at $10,000 and proposes to do a general electrical contracting business and deal in fixtures and supplies.

The Boone Power Company of Logan, W. Va., has been incorporated by M. A. Maxwell, James Jones, A. M. McCormick, B. M. Pirrung and L. S. Hill, all of Logan. The company is capitalized at $5,000 and proposes to supply electricity for lighting and industrial purposes in Logan County.

The Starter & Ignition Service Company of Rochester, N. Y., has been incorporated with a capital stock of $5,000 to deal in autos, motor boats, aeroplanes, prime movers, etc. The incorporators are: W. F. Bouche, C. L. Hartemenn and J. A. Fish, 283 Lakeview Park, Rochester, N. Y.

The Intermountain Power Company of Butte, Mont., has been incorporated with a capital stock of $500,000 for the purpose of developing additional water power in the State of Montana. The directors are: C. F. Kelley, Charles J. Kelley, John Gillie, L. O. Evans and Eugene Carroll.

The Triangle Electro Trading Company of New York, N. Y., has been incorporated by J. Male, D. L. Graff and B. Berwick, 1629 Madison Avenue, New York, N. Y. The company is capitalized at $5,000 and proposes to deal in electric and other novelties, motor supplies and accessories.

William T. Dippel of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 to carry on a general electrical and mechanical engineering and contracting business. The incorporators are: P. J. Slattery, J. A. Ryan and W. T. Dippel, 52 Vanderbilt Avenue, New York, N. Y.

The Commercial Electrolytic Corporation of New York, N. Y., has been chartered with a capital stock of $150,000 to deal in drugs, medicines, devices, instruments, etc. The incorporators are: A. W. Brand, 330 Park Avenue, New York, N. Y.; C. A. Buerk, 525 Deming Place, Chicago, Ill., and L. Molin, Seattle, Wash.

The Miller Reese Hutchinson Company of Jersey City, N. J., has been incorporated by Alexander Garbe, Robert A. Van Voorhis and H. T. Letts, all of Jersey City, N. J. The company is capitalized at $125,000, and proposes to manufacture electric motors and operate a general machine manufacturing business.

The England (Ark.) Public Service Company has been chartered with a capital stock of $100,000 and proposes to generate and distribute electricity, operate an ice factory and waterworks system in England, Ark. The officers are: M. D. Goldsby, president; C. L. Emerson, vice-president, and R. L. Buffalo, secretary and treasurer.

The Doyle-Da Costa Manufacturing Company of Trenton, N. J., has filed articles of incorporation in the State of Pennsylvania with a capital stock of $50,000 for the purpose of manufacturing insulated wire. The company will establish a plant in Easton. The incorporators are: William L. Doyle and Robert C. Da Costa of Trenton, N. J.

The Fuel Gas Generating Company of New York, N. Y., has been incorporated with a capital stock of $100,000 by G. F. Jebbett, 265 West 122nd Street, New York, N. Y.; E. A. Gingras, Englewood, N. J., and F. D. Stoba, 298 Palmetto Street, Brooklyn, N. Y. The company proposes to manufacture engines, generators, storage batteries, etc.

The Upper Paxton Township Electric Light & Power Company of Millersburg, Pa., has been chartered with a capital stock of $5,000 to supply electricity for lamps, heaters and motors in Upper Paxton Township. The incorporators are: Farley Gannett, Theodore F. Seelye and Samuel W. Fleming, Jr., all of Harrisburg, John S. Fisher of Indiana, H. J. Thompson of Bellefonte and A. J. Musser of Clearfield, Pa.

The Great Eastern Power Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $200,000 to do a general electrical and mechanical engineering business and also to manufacture and sell generators, motors, engines and other electrical and engineering apparatus. The incorporators are: Clement M. Egner of Elkton, Md., Norman P. Coffin and Herbert E. Latter of Wilmington, Del.

The Wabash Valley Electric Company of Clinton, Ind., has been incorporated with a capital stock of $250,000 by H. C. Dies, J. W. Robb and M. V. Robb of Clinton. This company, which is a consolidation of the Clinton (Ind.) Electric Light & Power Company and the Sullivan (Ind.) County Electric Company, will supply electrical service in the towns of Clinton, Sullivan, Dana, Jacksonville, New St. Bernice, Hymera, Shelburn, Farmersburg, Jasonville and Coalmont.

Trade Publications

Drills.—The Cleveland (Ohio) Twist Drill Company has issued its calendar for the year 1917, entitled "The Crucial Moment."

Victrola Light.—The Record Lite Company of Milwaukee, Wis., has issued a leaflet descriptive of its Record-Lite for Victrolas.

Electric Vehicles.—The Milburn Wagon Company, Toledo, Ohio, has issued a four-page leaflet descriptive of its new town car.

Wireless Apparatus.—Catalog No. R 7, descriptive of Mignon system, is being distributed by the Mignon Wireless Corporation, Elmira, N. Y.

Spot Lamps.—The Brenkert Light Projection Company, Detroit, Mich., has recently prepared an illustrated catalog descriptive of Brenkert Brenopticons and Brenkert Spot Lamps.

Lighting Fixtures.—Bulletin No. 37 is being distributed by Samuel Frost, 304 Bowery, New York City. This attractive bulletin is descriptive of fixtures designed especially for nitrogen lamps.

Cutting Machines.—The Oswego (N. Y.) Machine Works have recently prepared an introductory circular on their machines for cutting paper, books, boxes, board, cloth, tinfoil, celluloid, leather, rubber, cork, felt, etc.

Insulation.—The Armstrong Cork & Insulation Company, Pittsburgh, Pa., has prepared an illustrated booklet on "Nonpareil" corkboard insulation for cold storage warehouses, ice plants, creameries, breweries, etc.

Electric Melting Pots.—The Coin Machine Manufacturing Company, 984 East Seventeenth Street, Portland, Ore., is distributing a well-prepared and illustrated catalog on induction electric melting pot for typecasting machines.

Ventilating Fans.—The American Blower Company, Detroit, Mich., has recently issued bulletin No. 13 descriptive of its "ABC" disc ventilating fans. This bulletin contains considerable information concerning the construction and rating of this type of fan.

Pipe Fittings.—The Selah Manufacturing Company, 720 Prudential Building, Newark, N. J., is distributing a catalog descriptive of its threadless pipe fittings and their applications. This catalog is furnished in loose-leaf form for convenience in maintaining the series of data sheets.

Bilge Pumps.—Bulletin No. B-3000, descriptive of Yeomans electric bilge pumps, single and duplex for automatically raising surface water, drainage and sewage in basements below level of street sewers, municipal sewerage systems, etc., has been prepared by the Yeomans Brothers Company, 231 Institute Place, Chicago.

Insulation.—"Bakelite on the Automobile, Motorcycle, Motorboat and Aeroplane" is the title of a well-illustrated and prepared catalog recently prepared by the General Bakelite Company, 100 William Street, New York City. Examples of uses of Bakelite on ignition, starting and lighting apparatus, radiator caps, steering wheels, etc., are pointed out.

Lamp Sockets.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is distributing four descriptive leaflets on electric lamp sockets for general information; electric lamp sockets for fixture installation; electric lamp sockets for lamp cord suspension as in storerooms, factories, etc., and another on "What Socket Capacity Means," featuring why 660-watt capacity is essential to-day.

Separators.—Austin steam and oil separators of the standard, receiver and accumulator types for the elimination of water from live steam; extracting oil and impurities from exhaust steam, and the separation of oil, grit and moisture from compressed air, gas, etc., well illustrated and described in catalog No. 18 which has been prepared by the Austin Separator Company of Detroit, Mich.

Storage Batteries.—The Electric Storage Battery Company of Philadelphia, Pa., has issued handbook RB on the "Exide" battery for automobile starting, lighting and ignition service. This company has also issued handbook MS on miscellaneous types of batteries for automobile starting and lighting service and section LI on types LX and SX for lighting and ignition service for automobiles, motor boats and stationary gas and gasoline engines.

Electrical Cooking.—The Standard Electric Stove Company of Toledo Ohio, has recently issued a booklet on "Electrical Cooking" which contains a definition of electrical terms, brief advantages of electrical cooking, advantages of standard electric ranges, actual home costs of operating the standard range at different rates, standard electric oven current consumption, and many other interesting data concerning electric cooking.

Water Purification.—"The Trend of Modern Water Purification Methods," a paper read before the Southwestern Water Works Association in May, 1916, by C. Arthur Brown, chief engineer, engineering bureau, water purification division, American Steel & Wire Company, Chicago, Ill., has recently been distributed. This paper should be of great interest to municipal engineers and those concerned in the purification of water supply.

Meters and Relays.—Among the publications recently issued by the Westinghouse Electric & Manufacturing Company are a series of leaflets covering meters and relays of various types, including direct current meters of small diameter for use on automobiles, portable voltmeters and ammeters for testing purposes, and types CO Overload and CR Reverse Power alternating current Relays. These instruments are thoroughly illustrated and described in leaflets 3949, 3950 and 3814 respectively.

Railway Maintenance Equipment.—Special Publications No. 1574 is being distributed by the railway and lighting department of the Westinghouse Electric & Manufacturing Company of East Pittsburgh. This bulletin goes into detail about the modern railway, repair and inspection shops recently built, the Harvard shops of the Cleveland Railway Company. The latter is the most recent and most commented upon by many, as an excellent example of modern progress and efficiency. This bulletin is carefully illustrated.

Gas Engines.—"Inside Information" is the name of a new booklet just issued by the Bruce-Macbeth Engine Company, 2122 Center Street, N. W., Cleveland, Ohio. It is a handsomely printed book, showing views of engine rooms in which Bruce-Macbeth gas engines are in use, and giving a few definite "brass tack" figures and facts as to results that have been accomplished inside the engine room with Bruce-Macbeth gas engines. A partial list of users is also given which shows the character of firms using these engines. It contains just the kind of information the contemplating purchaser of a gas power plant is interested in knowing about the equipment he is considering.

Relays.—The Automatic Reclosing Circuit Breaker Company of Columbus, Ohio, has recently issued Bulletin No. 8, concerning its relays for use with automatic reclosing circuit breakers on direct-current circuits. Bulletin No. 10, entitled "Why Automatic Reclosing Circuit Breakers Should Be Used"; Bulletin No. 11, "The Theory and Operation of Automatic Reclosing Circuit Breakers"; Bulletin No. 12, "Type A Automatic Reclosing Circuit Breaker"; Bulletin No. 13, "Type C Automatic Reclosing Circuit Breaker"; Bulletin No. 14, "Type D Automatic Reclosing Circuit Breaker"; and Bulletin No. 20, "Important Considerations in the Protection of Individual Motor Circuits," have all been received recently.

Safety-First and Welfare Work.—Dr. Chas. A. Lauffer, Medical Director of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently delivered before medical societies, safety-first and welfare conferences, a series of papers dealing with disease and accidents in industrial plants, that have been favorably commented upon by the medical profession. Among these papers is one on the subject of "Sickness versus Accident" in which the author draws the conclusion, based on a wide experience in the Westinghouse plant, of the tendency of the employee to attribute ailment to accident rather than to sickness, thereby making the company liable for compensation damages which would not be the case were the ailment to be due to sickness. Dr. Lauffer has also presented papers on the subject of "Hernia" as an anatomical defect rather than an accident, and produces evidence from his own experience as well as letters from a number of prominent physicians to substantiate his arguments.

New England

BROWNFIELD, ME.—The saw mill and electric-light plant, owned by Charles Hill, in East Bownfield, was recently destroyed by fire. The power plant, it is understood, will be rebuilt.

ISLESBORO, ME.—Plans, it is reported, are being prepared by the proprietors of the Islesboro Inn for construction of a power house in Dark Harbor District. Evans & Warner, Witherspoon Building, Philadelphia, Pa., are architects.

LISBON, ME.—Work has begun on the new freight and power house to be erected at Lisbon Falls for the Lewiston, Augusta & Waterville Street Railway Company.

SOUTH BERWICK, ME.—The Berwick & Salmon Falls Electric Company of Dover, N. H., is considering the construction of a power plant. The work will include a concrete dam, about 240 ft. long and 16 ft. high, to cost about $100,000. I. Jones of Milton is engineer.

CENTER SANDWICH, N. H.—The local electric-light plant has been purchased by the H. B. Rust Company, of Providence, which own and operate the Meredith (N. H.) Electric Light Company. The new owners contemplate improvements to the system, which include the installation of an auxiliary steam plant or connecting it with the transmission lines of the Laconia (N. H.) Gas & Electric Company. The plant is now operated by water power.

BARRE, VT.—The Central Power Company, recently organized to develop water powers on Middlebury River and its branches, has applied to the City Council for a franchise to erect electric transmission lines into Barre.

MONTPELIER, VT.—The Central Power Company of Vermont has applied for a franchise to supply electricity in Montpelier. C. H. Thompson of Montpelier is interested in the company.

BOSTON, MASS.—The Bay State Street Railway Company has been authorized to issue $2,500,000 in coupon notes, the proceeds to be used for reconstruction of track and overhead equipment and replacing rolling stock. New power plant equipment, it is understood, will be purchased, which will include two 2500-kw. turbo-generators, one for the Chelsea station and the other for the Lynn station; three 400-hp., two 150-hp. and two 250-hp. boilers.

NEW BRITAIN, CONN.—An electric transmission line is being erected from the electric generating plant of the Farmington River Power Company at Poquonock to the factories of the Stanley Works in New Britain. The entire output of the Poquonock plant (1200 hp.) will be used by the Stanley Works. The proposed line will cost about $50,000 and will be more than 25 miles long, passing through Bloomfield, Hartford and Farmington to New Britain. The Stanley Works recently secured the control of the Farmington company.

Middle Atlantic

BROOKLYN, N. Y.—The American Appliances & Machinery Manufacturing Company has moved into its new factory building at 161 Jamaica Avenue. The company is in the market for entire new equipment throughout the building, including electric-wiring, motors, lamps, etc. Alternating current will be used. The company would like to receive catalogs, prices, etc. Herbert H. Giles is secretary and treasurer.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Dec. 27, for construction, heating, plumbing and drainage, electrical work and refrigerating equipment for storehouse and cold storage building at the Brooklyn State Hospital, Brooklyn, N. Y. Drawings and specifications may be seen at the Brooklyn State Hospital, Brooklyn; at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and at the Department of Architecture, Capitol, Albany.

ELLENBURGH, N. Y.—A contract has been placed by Thomas Hobbs of Ellenburgh, with Ruser & Muller of Malone, for the installation of a complete electric light plant in Ellenburgh. The equipment will include a 16-kw. Crocker-Wheeler, direct-current generator, directly connected to a 25-hp. internal combustion engine; the erection of distribution lines, etc.

FAR ROCKAWAY, N. Y.—The Queens Borough Gas & Electric Company, it is reported, contemplates the construction of a power station on Clinton St., to cost about $90,000.

GOSHEN, N. Y.—Bids will be received by William Williams, Commissioner of Water Supply, Gas and Electricity, Room 2318, Municipal Building, New York City, until Dec. 27, for furnishing electric current for lamps and motors to the Department of Correction Buildings, at New Hampton Farms, Goshen, from Jan. 1 to Dec. 31, 1917. Specifications may be obtained at the above office.

NEW YORK, N. Y.—The Public Service Commission has awarded a contract to the H. C. Stowe Construction Company, Brooklyn, for erecting 13 signal towers on the new elevated structures which are being built to extend the Manhattan subways into the Bronx and Queens Borough, at $110,651.

NEW YORK, N. Y.—Bids will be received by the Fire Department, Department of Water Supply, Gas and Electricity and Park Board, at the office of the central purchasing committee, Room 1220, Municipal Building, New York City, until Dec. 28, for furnishing batteries and spark plugs.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Municipal Building, New York City, until Dec. 27 for furnishing incandescent electric lamps from Jan. 1, 1917, to Dec. 31, 1917. Specifications, etc., may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Burdette C. Lewis, commissioner of correction, Municipal Building, New York City, until Dec. 29 for furnishing labor and material necessary for changing the two-wire generating system at the city prison, Centre Street, borough of Manhattan, to three-wire system complete with balancer sets. Plans and specifications may be seen at the above office.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2318, Municipal Building, New York City, until Dec. 30 for furnishing ornamental iron pedestals, columns sleeves, mast arms complete with spires, scrolls, bolts, clamps and two-piece canopies and steel shafts. Bids will also be received at the same time and place for furnishing prismatic glass band refractors, metal holders and canopies for use with incandescent street-lighting fixtures. Blank forms, specifications, etc., may be obtained at the office of the corporation counsel, Room 2324 Municipal Building.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Tenth Floor, Municipal Building, New York City, until Jan. 5, 1917, for furnishing labor and material as follows: (1) General construction work and electrical work (exclusive of plumbing, heating and ventilating); (2) plumbing and drainage work; (3) heating and ventilating work for construction and completion of cottage dormitory No. 8; cottage dormitory No. 9; high grade female dormitory No. 23; staff house No. 37; infirmary No. 50, at Randall's Island. Blank forms and further information may be obtained at the office of Donn Barber, architect, 101 Park Avenue, New York, N. Y. John A. Kingsbury is commissioner.

OSWEGO, N. Y.—Plans for the proposed hydroelectric plant to be erected at the Oswego River dam No. 6, at a cost of about $600,000, have practically been completed. The power house will be 50 ft. by 120 ft., one story. John A. Bensel, 111 Broadway, New York, N. Y., is consulting engineer.

OTISVILLE, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2318, Municipal Building, New York City, until Dec. 27, for furnishing electric current for lamps and motors to the buildings on the grounds of the tuberculosis sanatorium of the Department of Health at Otisville, in the town of Mount Hope, from Jan. 1, 1917, to Dec. 31, 1917. Specifications, etc., may be obtained at the above office.

RENNSSELAER, N. Y.—The Bayer Chemical Company, it is reported, has awarded a contract for construction of power plant, 50 ft. by 75 ft., one story high, to the Oscawana Building Company, 101 Park Avenue, New York, N. Y.

SONYEA, N. Y.—Bids will be received by Percy L. Lang, president of board of managers, Craig Colony for Epileptics, Sonyea, until Jan. 9, for construction, heating, plumbing and drainage and electric work for dormitories 2 and 3 at Craig Colony for Epileptics. Plans and specifications may be consulted at the Craig Colony for Epileptics, Sonyea; at the New York office of the Department of Agriculture, Room 1224, Woolworth Building, and the Department of Architect, Capitol, Albany. Lewis F. Pilcher, Capitol, is state architect.

WARWICK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2318, Municipal Building, New York, N. Y., until Dec. 27, for furnishing electric current for lamps and motors to the board of inebriety buildings, Inebriates' Farm, Warwick, N. Y., from Jan. 1, 1917, to Dec. 31, 1917. Specifications, etc., may be obtained at the above office.

DOVER, PA.—The Public Service Commission has approved of plans submitted by the Dover-Rossville Transit Company to operate a trackless trolley railway between Dover and Rossville. Electricity to operate these cars will be received through overhead wires.

JENKINTOWN, PA.—Contract has been awarded by the Philadelphia & Suburban Gas & Electric Company of Philadelphia for the construction of a new building, 40 ft. by 60 ft., for its local service.

MILLERSBURG, PA.—Steps have been taken to consolidate the Juniata Company of Mifflin; the Newport (Pa.) Electric Light Company and the Millersburg Electric Light, Heat & Power Company, under the name of the Juniata Public Service Company. Energy will be supplied from the power plant at Millersburg and a twenty-four-hour service established in all the towns.

PHILADELPHIA, PA.—The contract for the erection of an addition to the building of the Philadelphia Electric Company at Tenth and Chestnut Streets, has been awarded to John R. Wiggins Company.

ALLENHURST, N. J.—Bids will be received by the Commissioners of Allenhurst until Dec. 26, for furnishing two two-stage, volute centrifugal pumps, two motors for operating pumps (65 or 75-hp.), horizontal splash-feed compressor, motor for operating same, three transformers, 76-kw., single-phase, 2300 volts. Charles E. King is borough clerk.

MONTCLAIR, N. J.—Bids will be received by Lambert L. Jackson, secretary of board of education, 22 Valley Road, Montclair, until Jan. 2, 1917, for alterations to the Watchung School, consisting of general construction, plumbing, heating and ventilating, and electrical work. Separate bids to be submitted on each division of the work. Bids will also be received at the same time and place for alterations to the Nishuane School, comprising general construction, plumbing, heating and ventilating and electrical work. Separate bids to be submitted on each division of the work. Plans may be obtained at the office of Starrett & Van Vleck, architects, 8 West Fortieth Street, New York, N. Y., upon deposit of $10. Plans may be seen at the office of the board of education, 22 Valley Road, Montclair.

BLUEFIELD, W. VA.—The Appalachian Power Company is making extensions and improvements to its system, including a connection with the generating and transmission system of the Norfolk & Western Railway Company.

CLARKSBURG, W. VA.—The Hartland Coal Company, owned by capitalists of Clarksburg and New York, N. Y., is planning to build a power plant on Mill Creek in Clay County, to cost about $750,000, to supply electricity for mills and mines on the Elk River, between Charleston and Sutton.

ROANOKE, VA.—Extensive improvements are contemplated by the Virginian Railway Company in Roanoke and at Sewall's Point, which will include an entirely new system of handling, dumping and loading, increasing the capacity from 1800 to 5400 tons per hour, additional trackage, new viaduct, etc., and additional power supplied to the substation. Contracts have been placed with the Wellman-Seaver-Morgan Company at Cleveland, Ohio, for all new equipment. The cost of the proposed improvements is estimated at $3 000,000.

WASHINGTON, D. C.—The National Capitol Hotel Company of Washington, has awarded contract to Nelson & Lewin of Chicago, Ill., for construction of hotel at Pennsylvania Avenue, Fifteenth and F Streets, to cost about $1,000,000. Two to one overhead traction electric elevators will be used. J. Ellis Powell, Union Trust Building, Washington, D. C., is consulting engineer. Carrere & Hastings, Forty-fifth Street and Vanderbilt Avenue, New York, N. Y., are architects.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central

DETROIT, MICH.—Bids will be received at the office of the secretary of the board of education, 50 Broadway, Detroit, until Dec. 26 for construction of a 16-room school building on Cardona and Hindle Avenues, as follows: For the entire work; also separate bids on general mason work, general carpenter work, heating, ventilating and plumbing and electrical wiring. Specifications may be seen at the office of H. C. Wetzel & Company, architects, Dime Bank Building, Detroit.

DETROIT, MICH.—Bids will be received at the office of the secretary of board of education, 50 Broadway, Detroit, Mich., until Dec. 26 for construction of the Kennedy High School building, as follows: Proposals will be received for the entire work; separate bids will also be received for general mason work, general carpenter work, heating, ventilating and plumbing and electrical work. Specifications may be seen at the office of Mildner & Eisen, 724 Hammond Building, Detroit, architects. Charles A. Gadd is secretary.

GRAND RAPIDS, MICH.—The Cascade Electric Company, it is reported, has submitted a proposal to the City Council offering to sell its entire rights and holdings on the Thornapple River to the City for $100,000; build a dam and erect a transmission electric line to Grand Rapids.

JACKSON, MICH.—The Michigan State Telephone Company has made an additional appropriation of $40 000 for extensions to cable system in Jackson and also a liberal appropriation for long distance lines. The plans provide for two additional copper circuits between Detroit and Jackson.

PORT HURON, MICH.—Extensive improvements are contemplated by the Grand Trunk Railway Company at Port Huron, involving an expenditure of about $700,000, and which will include a power house, equipped with six 150-hp. boilers serving double steam generating units of 300 kw. for furnishing electricity for lamps and operating machinery, which will be motor driven, passenger shop, freight car shop, a cabinet shop, blacksmith and machine shop, wood mill, dry lumber shed storehouse, an office building, transfer table, etc.

ALLIANCE, OHIO.—The Stark Electric Railroad Company, it is reported, contemplates the construction of an electric railway between Alliance and Marlboro, a distance of 6 miles, during 1917.

CANTON, OHIO.—The Central Power Corporation, formed by a consolidation of the Canton Electric Company, the Sunnyside Electric Company and the Ohio Light & Power Company, contemplates extensive improvements to its plants and systems.

CLEVELAND, OHIO.—A permit has been granted to Swift & Co. for the erection of a power house at 3243 West Sixty-third Street.

CLEVELAND, OHIO. — Subway approaches to the new high level bridge are to be lighted by a "daylight" system. These lamps are so arranged that it will not be necessary for cars in the subways to be lighted.

MONROE, OHIO. — The Middletown (Ohio) Gas & Electric Company contemplates extending a transmission line to Monroe to supply electrical service here.

MOUNT GILEAD, OHIO—Extensive improvements and extensions are contemplated to the plant of the Hydraulic Press Manufacturing Company, including a new power plant, machine shop, etc.

NEWARK, OHIO.—Bids will be received by W. C. Christian, director of public service of the city of Newark until Jan. 3, 1917, for the purchase of the following material: One 200-hp. water tube boiler, three return tube boilers, one Hamilton Corliss engine and one Westinghouse 10-kw. direct-current exciter. Bids will be considered upon any one piece of the apparatus or upon the whole.

SPRINGFIELD, OHIO.—The Springfield Troy & Piqua Railway Company, it is announced, has been reorganized under the name of the Springfield Terminal Railway & Power Company. Bonds to the amount of $250,000 have been sold to provide funds to take care of the proposed increase in business. The company has closed contracts for furnishing electricity for lamps and motors in all the towns between Springfield and Troy on the Springfield & Piqua Interurban Railway. C. W. Anderson of Chicago, Ill., and Walter E. Bowyer of Troy are interested in the new company. John L. Bushnell of Springfield retains an interest in the business.

COVINGTON, KY.—Plans have been prepared for a large addition to the plant of the Kelley-Koett Company, maufacturers of X-ray apparatus, at its plant at 122 West Fourth Street.

LAFAYETTE, IND.—The Fort Wayne & Northern Indiana Traction Company is in the market for a 125-kw., three-phase, 25-cycle, 2200-volt generator, oil or gas engine and switchboard complete. J. Abbott is local superintendent.

MUNCIE, IND.—The municipal electric distribution system has been sold to John Stockdale of Anderson for $28,123, subject to the approval of the Public Service Commission.

BERWYN, ILL.—Bids will be received by the City Council of the city of Berwyn, Ill., until Jan. 2, 1917, for the installation of a fire-alarm system in North Berwyn. For details see proposal columns.

DIXON, ILL.—The Illinois Northern Utilities Company contemplates a large extension to its Dixon plant, to cost, including equipment, about $300,000.

SPRINGFIELD, ILL.—Extensive improvements, involving an expenditure of $700,000, for improvements to the local electric-light plant, street railway system and gas works are under consideration by the Springfield Railway & Light Company.

STREATOR, ILL.—The Public Service Company of Northern Illinois is planning to install a Gertainer & Davis vacuum ash-conveyor at its local plant. The company also contemplates the installation of four 150-amp. General Electric regulators on its transmission line to Lacon.

URBANA, ILL.—Arrangements are being made for an extensive building program at the University of Illinois, involving an expenditure of $8,000,000. The plans provide for the erection of a new agricultural building, to cost $2,000,000; engineering plant, at $2,000,000; library, $1,000,000; museum, $1,000,000; gymnasium $1,000,000, and other buildings, $1,000,000.

AMHERST, WIS.—Steps have been taken by the Amherst Electric Company to secure a franchise to supply electricity in Amherst Junction, 3 miles distant. Arrangements have been made by the county board to erect a private line, if the franchise is granted, to supply energy to the county farm.

PORTAGE, WIS.—Offices have been opened in Portage by T. C. Rutz, engineer of the construction department of Woodmansee & Davidson, consulting engineers, of Chicago, Ill., through which all construction work for the Wisconsin Power, Light & Heat Company, including the building of a new auxiliary power plant here and the erection of 107 miles of new transmission lines to Portage will be done. The new power station in Portage will be connected with eleven cities and villages in the immediate vicinity.

PRAIRIE FARM, WIS.—The property of the Prairie Farm Electric Company is reported to have been purchased by the G. E. Scott estate. Improvements to the plant are considered by the new owner.

RIVER FALLS, WIS.—The installation of an ornamental street-lighting system in the spring is under consideration by the City Council.

SUPERIOR, WIS.—The Continental Truck Company has awarded a contract for construction of power house for factory to Walter Carter of Superior. Contacts for equipment, it is understood, have not been let. Dr. J. G. Barnsdale, 618 Tower Avenue, is secretary of the Continental company.

CANBY, MINN.—The Citizens Light, Heat & Power Company has been granted a franchise to supply electricity in Clear Lake and Gary, S. D. The company will erect an electric transmission line to both places. Emil W. Erick is general manager.

COMFREY, MINN.—Bids will be received by H. D. Reed, clerk of board of education, independent school district No. 29, of Brown and Cottonwood Counties, Comfrey, until Jan. 15, 1917, for construction of a consolidated school building at Comfrey. Separate bids to be submitted for heating and ventilating, plumbing and electric wiring. H. C. Gerlach, of Mankato, is architect.

TOWER, MINN.—The City Council is considering the installation of a 125-hp. engine in the municipal electric light plant.

CARROLL, IOWA.—Bids will be received by the board of education until Dec. 28 for construction of a school building, including hot water heating, electric wiring and plumbing. The cost of the building is estimated at $70,000. C. A. Dieman & Company, Granby Building, Cedar Rapids, are architects.

DEEP RIVER, IOWA.—Plans are being considered for the installation of new equipment in the municipal electric plant.

FORT DODGE, IOWA.—Bids will be received by the board of education until Jan. 8, 1917, for construction of Oleson School building, including fan ventilating system, vacuum steam heating, electric wiring, etc. Max Nippell, 2 Snell Building, Fort Dodge, is architect.

SHENANDOAH, IOWA.—The proposal to establish a municipal electric-light and power plant in Shenandoah was carried at an election held recently.

TIPTON, IOWA.—The County Board is considering the installation of an electric-light plant in the new county home building.

JOPLIN, MO.—The City Council is considering calling an election to submit to the voters the proposal to issue $175,000 in bonds for enlarging the municipal electric-light plant and ice factory.

BOWDON, N. D.—The local electric-light plant is reported to have recently been destroyed by fire, causing a loss of about $2,500.

ESMOND, N. D.—Preparations are being made by the Town Council for the installation of an electric-lighting plant in Esmond.

LIDGERWOOD, N. D.—The local electric-light plant, owned by the Lidgerwood Mill Company, has been purchased by A. M. Baker of Fargo, and others. The new owners contemplate improvements to the plant.

McHENRY, N. D.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

MINOT, N. D.—Bids will be received until Jan. 8, 1917 (readvertisement) for extensions to the ornamental street-lighting system. A. D. Hagenstein is city auditor.

WARWICK, N. D.—Plans have been completed by Harry Johnson, owner of the local garage, for the installation of an electric-light plant in the spring to supply electricity to the town.

FREMONT, NEB.—Bids will be received at the office of the county clerk of Dodge County, Fremont, until Jan. 22, 1917, for construction of a court house to be erected in Fremont. Separate bids to be submitted on electrical work, heating and plumbing. Plans and specifications are on file at the office of the A. H. Dyer Company of Fremont, architects.

HAVELOCK, NEB.—The board of education has awarded general contract for the construction of high school building in Havelock to H. F. Jones of Cedar Rapids, Iowa, at $78,989. Action will soon be taken on heating, electric wiring and plumbing contracts. W. F. Gernandt, Keeline Building, Omaha, Neb., is architect.

ODELL, NEB.—James Barry, owner of the local electric-light plant, which was recently destroyed by fire, it is reported, will rebuild the plant as soon as possible. The town is at present without electrical service.

HOLTON, KAN.—Plans are being considered for replacing one of the generating units in the municipal electric-light and water plant with a new 150-kw. unit; a Skinner engine will probably be included.

LA CROSSE, KAN.—At an election to be held Dec. 28 the proposal to issue $12,500 in bonds for an electric-light plant and $40,000 for water-works system will be submitted to the voters. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

MUNDEN, KAN.—An election will be held Dec. 28 to submit to the voters the proposal to issue $20,000 in bonds for the installation of an electric-light plant and water works system. Stevens & Stiles, Commerce Building, Kansas City, Mo., are engineers.

Southern States

CONOVER, N. C.—Preparations are being made for the erection of a new factory (200 ft. by 80 ft.) for the Yount Cotton Mills of Newton, N. C., in Conover. All machinery, it is understood, has been purchased except the electric system, which will include a 300-kw. generator.

GREENVILLE, N. C.—At a mass meeting held recently the citizens voted to install an additional boiler, turbine, condenser, pumps and new filters at the water and light plant, and also to extend the water and sewer systems. H. L. Allen is superintendent.

AUGUSTA, Ga.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 11, 1917, for a new refrigerating machine in the United States Post Office and Court House at Augusta, Ga. For details see proposal columns.

MEMPHIS, TENN.—A compromise has been effected between the city officials and the electric light companies of Memphis whereby the proposed municipal electric-light plant will not be built for the present.

The city reserves the right to install a municipal plant any time in the future. The $1,500,000 municipal plant bonds have been cancelled.

HUNTINGTON, ARK.—A utilities corporation, of which Albert Manuel of Dayton, Ohio, is president, is reported to have taken options on the property of the Coal & Gas Belt Electric Company of Huntington; the Greenwood (Ark.) Light & Power Company and the Booneville (Ark.) Light & Power Company. If the deal goes through, it is reported, that a large plant, to cost about $250,000, will be erected at Huntington to supply electricity for lamps and motors in a number of towns in the coal belt of Sebastian County and in towns from Mansfield to Booneville and surrounding territory. Raymond F. Rice of Lawrence, Kan., is attorney for the Emanuel corporation.

INDEPENDENCE, LA.—Bids will be received by the Mayor and Board of Aldermen of the town of Independence until Jan. 9, for construction of water works system and furnishing equipment, including crude-oil engines, pumps, steel tower and tank, reservoir, pumping station, etc. Specifications, etc., may be obtained on application to Xavier A. Kramer, consulting engineer, Magnolia, Miss., or at the office of the Mayor of Independence.

MOUNTAIN PARK, OKLA.—Bonds to the amount of $4,500 have been voted for the installation of an electric-light plant in Mountain Park.

PONCA CITY, OKLA.—The Municipal Water and Light Department will install an additional generating unit of about 200 kw. capacity in the municipal electric plant in the near future. A high speed directly connected unit is contemplated. Philip R. Dunton is superintendent.

ROCKY, OKLA.—C. A. Mayhew, recently granted an electric-light franchise in Rocky, contemplates the installation of an electric plant, to cost about $2,000. The equipment of plant will include a 15-kva. generator and a 15-hp. oil engine.

ALTO, TEX.—The electric plant of the Alto Light & Power Company, which was recently destroyed by fire will be rebuilt.

HIGGINS, TEX.—Bonds have been issued for the installation of a municipal electric-light plant and water-works system.

NEWCASTLE, TEX.—The Newcastle Light & Power Company, recently granted a franchise, is planning to install an electric plant, to cost about $8,000. The plans provide for a development of from 100 to 125 hp. J. A. Nelson is engineer.

PEARSALL, TEX.—The Pearsall Electric Light Company is contemplating rebuilding its electric light system.

SAN ANTONIO, TEX.—The City Commission is considering the installation of an electric police signal system, to cost about $50,000. The plans provide for the installation of about thirty stations.

SHINER, TEX.—The City Council is contemplating the installation of a crude oil engine, dynamo and other equipment in the municipal electric-light plant.

VICTORIA, TEX.—Plans are being considered by the Victoria Civic Association for the installation of an ornamental lighting system in the public square.

WACO, TEX.—The City Commission has agreed to maintain an extension to the city lighting system if installed by the Young Men's Christian Association as per plans submitted.

Pacific States

ANACORTES, WASH.—Investigations are being made by the Puget Sound Traction, Light & Power Company of Seattle with a view of extending its transmission lines to Anacortes.

CLARKSTON, WASH.—Liggett, Hichborn & Company, 61 Broadway, New York, N. Y., have purchased the electric light, power and water properties of the Lewiston-Clarkston Improvement Company, which serves several communities in Oregon. A new company has been formed known as the Washington-Idaho Water, Light & Power Company.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company will soon begin work on the erection of an electric high-tension transmission line from Newport to Dalkeena, a distance of 12 miles.

NORTH YAKIMA, WASH.—Investigations will be made by H. M. Gilbert, president of the Tieton Water Users' Association, relative to the construction of a hydroelectric plant on the present Tieton Canal and at the McAllister Meadows. It is estimated that 100,000-hp. can be developed.

OLYMPIA, WASH.—The American District Steam Company has applied to the City Council for a franchise to supply power, light and steam heat in Olympia for a period of 50 years.

RITZVILLE, WASH.—The Washington Water Power Company, it is reported, will rebuild its local system at once. New transformers will be installed and the street-lighting system extended and improved.

SEATTLE, WASH.—The Seattle & Rainier Valley Railway Company contemplates the construction of an electric railway to Renton. The cost is estimated at $100,000.

SEATTLE, WASH.—Bids will be received by J. R. Freeman, city purchasing agent, until Jan. 29, for 450,000 lamps, to be used by the lighting department during the year 1917. The cost of the lamps is estimated at $120,000.

SEATTLE, WASH.—Plans and specifications have been completed by J. D. Ross, superintendent of lighting, for a second unit addition to the municipal steam auxiliary plant of Lake Union, which will increase the output from 7500 to 15,000 kw. The cost is estimated at $350,000. The Board of Public Works has been instructed to call for bids at once. Bids will be taken on the entire work, or the following divisions, according to present plans: (1) Boilers, feed pumps and service pumps; (2) steam turbo-generator, reactance coils, exciter, etc.; (3) high vacuum condenser set air and water pumps. Bids, it is stated, will not be taken for construction of power plant until after the machinery contracts have been let.

SEDRO WOOLLEY, WASH.—A petition has been presented to the City Council asking for the installation of street lamps on Township, State, Talcott and Bennett Streets.

KALAMATH FALLS, ORE.—The California-Oregon Power Company, it is reported, will soon install a new street-lighting system in Klamath Falls, to cost about $10,000.

KLAMATH FALLS, ORE.—At an election held recently the proposal to grant the Keno (Cal.) Power Company a 50-year franchise to supply electricity throughout the city was carried.

CLAREMONT, CAL.—Bids will be received by the City Trustees of Claremont until Jan. 2, for the installation of an ornamental street-lighting system on First Street. Marbelite standards are specified.

COLTON, CAL.—The Fontana Power Company of Colton is reported to have completed plans for the construction of an 1800-kw. hydroelectric plant.

LOS ANGELES, CAL.—Bids will be received by H. J. Lelande, county clerk, Los Angeles, until Jan. 2, for furnishing and installing elevator enclosures and cars for passenger and freight elevators in the service building at the County Hospital.

RIVERSIDE, CAL.—The Southern Sierras Power Company, it is reported, is planning to erect a high-tension transmission line from either Niland or El Centro, Imperial County, to Hanlon Heading. This is part of the power system being built to irrigate 500,000 acres in the Imperial Valley by water taken from the Colorado River. The cost is estimated at $300,000.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has announced the completion of the Halsey hydroelectric station at Lake Spaulding reservoir. This plant with the Wise plant nearly ready for operation will add 33,330 hp. to the generating capacity of the company. Work will begin on a fourth hydroelectric development of 33,333 hp. at Lake Spaulding in the spring.

SANTA BARBARA, CAL.—A petition has been filed with the City Council by the property owners along State Street asking for the installation of an ornamental lighting system, using Marbelite standards. The work to be done under the Vrooman Act.

BRIGHAM, UTAH.—The City Council is considering calling an election to vote on the proposal to issue $10 000 in bonds for rebuilding the municipal electric-light plant.

DOUGLAS, ARIZ.—Bids will be received by the city clerk of Douglas, Ariz., until Dec. 27 for complete installation of an ornamental lighting system, consisting of approximately 107 cast-iron single lamp standards, 23,000 ft. No. 6 solid lead-covered, rubber-insulated cable, 8,000 ft. 2-in. conduit, necessary foundations, etc. For details see proposal columns.

LIBBY, MONT.—The International Power & Construction Company has filed a condemnation suit against the Great Northern Railway Company and David R. McGinnis, to make it possible to build a dam to develop the water power of the Kootenai River at Kootenai Falls, to generate electricity. Leo H. Faust and C. E. Lukens are interested in the company.

COKEVILLE, WYO.—I. McNeice is reported to be interested in the construction of an electric light plant on Pine Creek.

PUEBLO, COL.—The Arkansas Valley Railway, Light & Power Company is planning to extend its electric transmission lines from Pueblo to Avondale.

Canada

COURTENAY, B. C.—Steps have been taken by the City Council to compel the Courtenay Electric Light, Heat & Power Company to remove its pole lines from the city.

VANCOUVER, B. C.—Steps have been taken by the city of Vancouver to secure an option of the water rights on the Bridge River, near Lillooet, about 150 miles distant. Application will be made to the Legislature, at the next session, for an amendment to the city charter to enable the municipality to develop the power and to construct and operate a municipal electric plant.

VERNON, B. C.—The by-law authorizing extensions to the electric lighting system has been approved by the ratepayers.

MIDDLETON, N. S.—The erection of an electric transmission line from Nictau Falls to Middleton, to cost about $37,000, has been authorized by the ratepayers.

BRIGDEN, ONT.—Estimates are being secured by the Town Council for the installation of a hydroelectric system.

EMBRO, ONT.—Extensions to the hydroelectric system is under consideration by the West Zorra Township Council. Allen Murray of Embro is clerk.

OTTAWA, ONT.—The City Council has adopted the recommendation of tht Board of Control authorizing the Ottawa Hydro-Electric Power Commission to make arrangements for power supply for the water works pumps.

PORT ARTHUR, ONT.—The City Council has decided to submit a by-law to the ratepayers at the January election authorizing the Hydro-Electric Power Commission to develop and transmit 30,000 hp. of electrical energy for the city. The power will be developed at Dog Lake.

ST. MARY'S, ONT.—A hydro-electric power by-law will be submitted to the ratepayers on January 1.

STRATFORD, ONT.—The contract for the construction of a substation on York Street has been awarded by the Public Utilities Commission to Robert Marson, 378 Nelson Street, at $9,695.

WELLAND, ONT.—Municipalities along the Canadian shore of Lake Erie between Port Colburne and Bridgeburg and the municipalities between Port Colborne and Welland along the east side of the Welland Canal, will vote on Jan. 1, or at special elections to be held soon after, on propositions guaranteeing bonds for a publicly owned hydroelectric radial railway. The cost of the proposed railway is estimated at $2,208,716. It will be built by the Ontario Hydro-Electric Commission.

Mexico

TAMPICO, MEX.—Plans are being considered by the Texas Company of Houston, Tex., it is reported, for the construction of a large electric power plant in Tampico for the purpose of supplying energy to operate the oil pipe line pumping plants and other machinery and equipment connected with its own industry and other concerns. The proposed electric transmission system will extend to all the oil fields in the Gulf coast region of Mexico.

Miscellaneous

VALDEZ, ALASKA.—The Prince William Sound Water, Light, Power & Telephone Company (a Seattle corporation) has purchased the property of the Iles Hydro-Electric Company of Valdez, at about $100,000. Both plants will be operated by the Prince William Company until extensions are made that will consolidate the plants at the hydroelectric site at Valdez.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Jan. 2 for furnishing crane chain, water gages, lamps, grease cups, electric hair driers, ignition cable, etc. Blanks and general information relating to this circular (No. 1107) may be obtained from the above office or the offices of the assisting purchasing agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

14,219. CENTRIFUGALLY-REGULATED POWER TRANSMISSION SYSTEM; William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Involving the use of dynamo-electric clutches.

1,207,705. OUTLET-BOX; William A. Bonnell, New York, N. Y. App. filed Aug. 31, 1914. Rosette.

1,207,718. ELECTRIC SWITCH; Frederick J. Decker, Rochester, N. Y. App. filed June 9, 1915. Adapted to be used with motor vehicles.

1,207,732. MOTOR-VEHICLE CONTROL; Justus B. Entz, Cleveland, Ohio. App. filed Jan. 13, 1915. System of electric power transmission and control.

1,207,736. ELECTROMAGNETIC DEVICE; Oscar F. Forsberg, Yonkers, N. Y. App. filed May 2, 1914. Plurality of magnets and armatures.

1,207,744. ASYNCHRONOUS MOTOR; Rudolf Goldschmidt, Darmstadt, Germany. App. filed May 21, 1912. Three-phase or induction motor having an armature which is provided with a single-phase winding.

1,207,748. ELECTRIC LANTERN; Paul Gruner, Pinckneyville, Ill. App. filed June 3, 1916. Hand lantern.

1,207,753. IGNITER FOR GAS ENGINES; Albert B. Herrick, New York, N. C. App. filed Feb. 4, 1915. Timing and circuit-breaking device.

1,207,754. ADJUSTABLE-CONTACT THERMOMETER; Alfred Theodore Hespe, Weehawken, N. J. App. filed Sept. 2, 1914. Adjusted over the entire scale.

1,207,812. CIRCUIT-CONTROLLER; Thomas George Stiles, Arlington, N. J. App. filed Aug. 13, 1913. Especially draw-bridge circuit-controllers of the sliding or plug-contact type.

1,207,871. STARTER FOR INTERNAL-COMBUSTION ENGINES; George R. Wadsworth, Cleveland, Ohio. App. filed Nov. 8, 1911. Especially engines employed in motor vehicles.

1,207,823. ANNUNCIATOR; John F. Webster, Limeboro, Md. App. filed June 6, 1916. For party-line telephone systems.

1,207,836. CONNECTING SYSTEM FOR TELEPHONE STATIONS; Leon D. Barrows, New York, N. Y. App. filed Dec. 20, 1915. Improvements.

1,207,838. NON-INTERFERENCE SIGNAL-BOX; Clarence E. Beach and Lee J. Voorhees, Binghamton, N. Y. App. filed Feb. 23, 1915. Arranged both to control the effectiveness of the signaling contacts and to control the running of the signaling train.

1,207,861. ELEVATOR-BRAKE; William H. Chapman, Portland, Me. App. filed March 10, 1915. Relates to elevators which are driven by polyphase alternating-current motors.

1,207,862. PROCESS AND APPARATUS FOR NEUTRALIZING STATIC ELECTRICITY; William H. Chapman, Portland, Me. App. filed April 22, 1916. For use on paper, cloth or other material.

1,207,876. ELECTRICAL ATTACHMENT; Harry Carden Despard, Syracuse, N. Y. App. filed April 24, 1915. Applied to ironing boards.

1,207,886. METALLIC-FILAMENT LAMP; Karl Farkas, New York, N. Y. App. filed Nov. 18, 1915. Electric reflector lamp.

1,207,912. CARBON-BRUSH CONNECTION; Raymond F. Hausen, Pittsburgh, Pa. App. filed April 14, 1915. Means for attaching electrical conductors to such brushes.

1,207,915. TIMING MECHANISM FOR ELECTRIC WELDING; John Allen Heany, New York, N. Y. App. filed Sept. 20, 1916. Period of current flow to the electrodes may be accurately regulated and varied.

1,207,919. LIQUID-LEVEL INDICATOR; Charles H. Holway, La Crosse, Wis. App. filed Feb. 4, 1915. Fuel reservoirs of motor vehicles.

1,207,922. BATTERY-ECONOMIZER; Arthur L. Jenks, Minneapolis, Minn. App. filed Jan. 10, 1916. For telegraph, telephone and electrical signal stations.

1,207,923. MOTOR-STARTER; Clay Jewell, Baltmore, Md. App. filed March 1, 1913. Automatic circuit closer and starter for direct-current motors.

1,207,944. VEHICLE DIRECTION-INDICATOR; William E. Lemp and Edward Keyland McQuillen, Mobile, Ala. App. filed Feb. 28, 1916. Headlight type.

1,207,950. RAIN-SIGNAL; Hugh Alvin Longino, La Grange, Ky. App. filed Oct. 20, 1915. Sound an alarm at the beginning of a rain storm.

1,207,956. CASING FOR ELECTRIC SWITCHES; James F. McElroy, Albany, N. Y. App. filed Aug. 29, 1911. Push-button type.

Record of Electrical Patents

Notes on United States Patents issued on Dec. 12, 1916.

1,207,957. THERMOSTAT; James F. McElroy, Albany, N. Y. App. filed Oct. 21, 1911. To be immune or neutral to abnormal vibrations in either a vertical or horizontal direction.

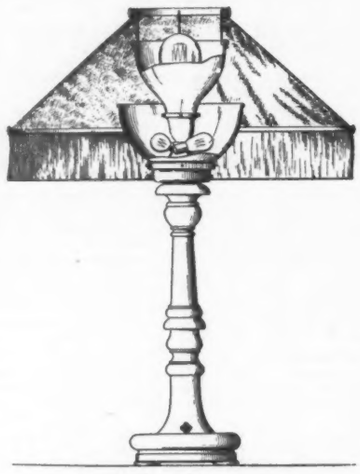
1,207,958. ATTACHMENT FOR ELECTRICAL CONDUITS; Adnah McMutrie, New York, N. Y. App. filed April 1, 1915. For securing the end of a pipe or sheath for electrical conductors to an outlet box.

1,207,959. PIPE-COUPLING; Adnah McMutrie, New York, N. Y. App. filed April 1, 1915. Improvements.

1,208,004. FUSE; Harry L. Reed, Dorchester, Mass. App. filed Dec. 17, 1915. Inclosed or cartridge fuses.

1,208,007. BURGLAR-ALARM; Orville K. Reynolds, Muskogee, Okla. App. filed Feb. 15, 1916. For use in banks.

1,208,026. TELEMETRIC SYSTEM; Arthur J. Smith, Bath, Me. App. filed June 3, 1912. For determining depths of one or more bodies of liquid located at a distance from the point where the reading or indications of such depths are to be made.



No. 1,208,540.—Lamp

1,208,034. IGNITION SYSTEM; Leo Andrew Snyder, Haileyville, Okla. App. filed May 8, 1915. Adapted for use in gas, gasoline, kerosene or other liquid fuel-heating or lighting apparatus.

1,208,044. TIME-LIMIT DEVICE FOR CHARGING STORAGE BATTERIES; Nathan H. Suren, Needham, Mass. App. filed July 22, 1910. Improvement.

1,208,047. TELEGRAPH-TRANSMITTER; Charles G. Taylor, Los Angeles, Cal. App. filed May 4, 1914. Provides a cheap, simple, compact, portable, light apparatus.

1,208,048. TROLLEY-SWITCH; James C. Thompson, Lemoyne, Pa. App. filed Feb. 25, 1915. New and useful improvements.

1,208,056. HIGH-TENSION RECTIFYING-SWITCH; Harry F. Waite, Whitestone Landing, N. Y. App. filed April 24, 1916. Rotating parts reduced to a minimum.

1,208,074. ELECTRICAL CONNECTING DEVICE; Frederick G. Allen, Erie, Pa. App. filed Nov. 3, 1915. Plug and socket type.

1,208,095. OIL-SWITCH; Charles A. Clark, New York, N. Y. App. filed Sept. 8, 1915. Contact-carrying means that can move only in one direction.

1,208,096. SOUNDER; Frederick W. Cole, Newton Highlands, Mass. App. filed Nov. 6, 1915. For use in signal-boxes where the sounding occurs upon the retractile movements of the armature of the sounder-magnet.

1,208,128. X-RAY TUBE; Charles A. Friedrich, New York, N. Y. App. filed Jan. 28, 1914. Method of thoroughly exhausting large amounts of metal in such tubes.

1,208,129. ALARM FOR KNOBS; Edward J. Fuller, New York, N. Y. App. filed March 2, 1915. Electrically operated.

1,208,142. ELECTRIC HEATER FOR BON-BON KETTLES; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 26, 1913. Comprise a plurality of heaters of different types.

1,208,143. ELECTRIC HEATING AND LIGHTING APPARATUS; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 26, 1913. Fixture having both lighting and heating elements.

1,208,146. MAXIMUM-INDICATOR FOR METERS; Chester I. Hall, Chicago, Ill. App. filed Nov. 29, 1911. For use in connection with instruments employed to measure the operation of meters in connection with which the indicator may be used.

1,208,147. CLOCK CONSTRUCTION; Chester .I Hall, Chicago, Ill. App. filed Nov. 22, 1912. Moving parts are driven by a weight so arranged that it is raised continuously as it drips so that the driving and winding operations progress simultaneously and continuously.

1,208,151. SWITCHBOARD; John P. Hayes, Pittsburgh, Pa. App. filed Sept. 8, 1914. Improvements in electric switches.

1,208,183. MOTOR-WINDING; Emil Mattman, Wilkinsburg, Pa. App. filed Feb. 17, 1913. Structure that shall be adapted for use as an alternating-current generator or as a synchronous motor.

1,208,187. APPARATUS FOR GENERATING HIGH-FREQUENCY ELECTRICAL OSCILLATIONS; Frederick Hoyer Millener, Omaha, Neb. App. filed April 10, 1911. Wireless or ethereal transmission of energy.

1,208,188. POST-TYPE ARC-LAMP; Frederick H. Miller, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Weather-proof.

1,208,205. COMBINED FIRE-ALARM AND WATCHMAN'S SIGNAL-TRANSMITTER; Charles E. Potter, St. Louis, Mo. App. filed Oct. 20, 1915. By the manipulation of a key send to a central station or receiving office a signal.

1,208,213. ELECTRIC COOKER; Walter Richmond, Memphis, Tenn. App. filed Oct. 24, 1911. Moisture arising from articles being baked may be removed without subjecting the oven to a chill or exposure.

1,208,217. SPRING FASTENING DEVICE; John Schade, Jr., New York, N. Y. App. filed Dec. 13, 1906. For the terminals of electrical conductors.

1,208,226. CONTROL SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed Sept. 8, 1914. High-voltage, direct-current control systems for railway motors.

1,208,228. TEMPERATURE-INDICATOR; Nathan H. Suren, Needham, Mass. App. filed Jan. 28, 1915. Predetermined signals are operated at certain arbitrary changes of temperature in places to be protected.

1,208,229. ELECTRIC SIGNAL SYSTEM; Nathan H. Suren, Needham, Mass. App. filed Feb. 13, 1915. The signals being based upon the use of a number of digits in each of a plurality of denominations to make up a composite signal.

1,208,238. APPARARUS FOR NEUTRALIZING STATIC CHARGES; Harry C. Tooker and Barton S. Hallenbeck, Yonkers, N. Y. App. filed March 24, 1914. Applicable to printing presses.

1,208,296. REPEATER; John J. Comer, Chicago, Ill. App. filed March 25, 1911. Microphone is operated by an electro-magnet.

1,208,302. VEHICLE SIGNALING DEVICE; Robert F. Duryea, San Francisco, Cal. App. filed Dec. 29, 1915. Stationary outer and a concentric, turnable inner cylinder.

1,208,304. DEAD-BEAT RECORDING INSTRUMENT; John W. Esterline, Indianapolis, Ind. App. filed Jan. 31, 1916. Record produced will be clear and accurate.

1,208,386. AUTOMATIC CURRENT-REVERSING MECHANISM; Henry K. Sandell, Chicago, Ill. App. filed May 1, 1914. Designed for constantly transforming the current.

1,208,393. WALL-CASE; Ezra E. Emart, Hartford, Conn. App. filed Oct. 14, 1915. Sectional wall-cases.

1,208,474. X-RAY SCREENING APPARATUS; Eugene W. Caldwell, New York, N. Y. App. filed Oct. 12, 1915. Cellular screen mounted between and preferably close to the subject and the plate.

1,208,540. LAMP; Francisco Laurent Godinez, Jersey City, N. J. App. filed April 6, 1916. To provide a lamp with a system for furnishing a restricted area with diffused light for combined direct and indirect illumination.

1,208,597. INCLOSED-ARC DEVICE AND METHOD OF OPERATING THE SAME; George M. J. Mackay, Schenectady, N. Y. App. filed Oct. 30, 1915. Having a cathode consisting of highly refractory material.